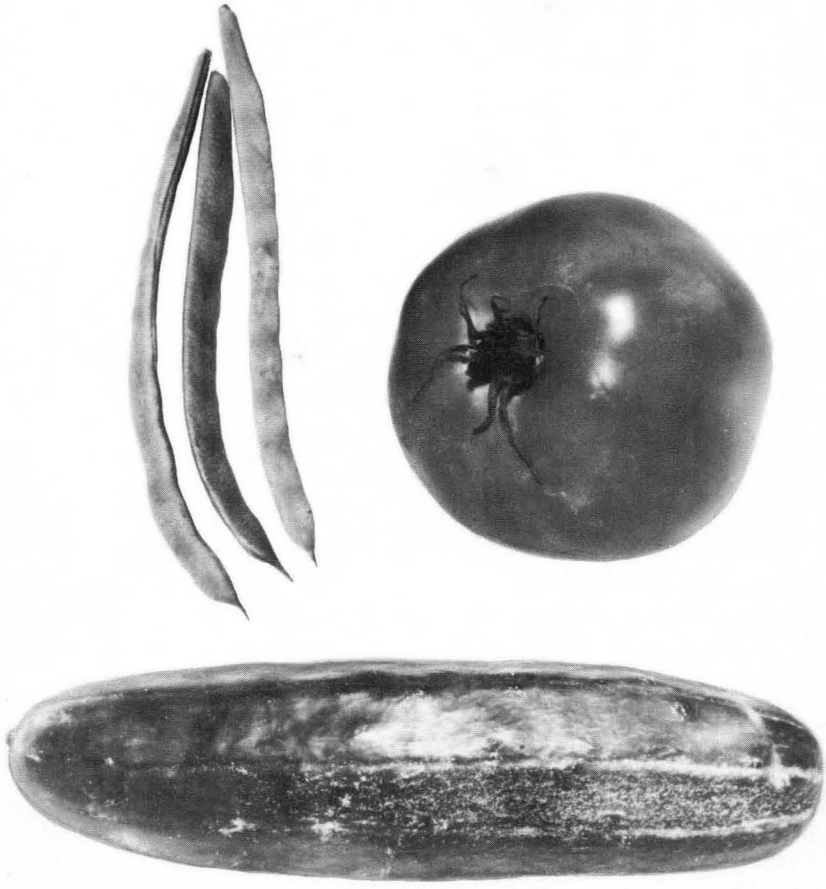

Demand Characteristics for VINE VEGETABLES in Honolulu, Hawaii 1947–1961

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FOREWORD

This report analyzes monthly prices for snap beans, cucumbers, and tomatoes at the Honolulu wholesale market. The first part of the study indicates the problem encountered, describes the methodology employed, and presents the results derived. Various statistical data used in the course of this investigation are given in the appendix.

The empirically determined monthly "demand" functions indicate how prices fluctuate in response to variations in certain related factors. They provide the basis for answers to some questions. Among these are:

1. What is the net price-quantity relation?
2. How does it shift seasonally and annually?
3. Are adjustments in production justified?
4. Is demand interrelated with procurement activities of large-scale food retailers?

This study represents the first attempt at making a detailed price analysis for Hawaii-produced vegetables. Although the results reported leave many questions unanswered, they do give some understanding of the price-making process for a few products sold in one market.

Research for the report was conducted under Hawaii's phase of Western Regional Marketing Project WM-40, entitled "Procurement Policies and Practices of Large-Scale Food Retailers." The Agricultural Experiment Stations of California, Colorado, Hawaii, Idaho, Oregon, Washington, and Wyoming, and the Economic Research Service of the United States Department of Agriculture are cooperating in conducting various phases of this regional research program. The study on which this report is based is financed by Federal funds authorized under the Hatch Act (amended), and allocated to Project 367 (revised) of the Hawaii Agricultural Experiment Station.

The author is indebted to Stephen M. Doue, Shiro Takei, Rokuro Yamaguchi, and Paul P. Wallrabenstein for educating him about details of Hawaii's agriculture. Thanks are also due to those who participated directly in preparing the report: Misses Jo Ann Kimura and Jean Foytik for performing voluminous statistical tasks without complaint; Miss Betty Kaya for drawing excellent charts; and Mrs. Fukuye Lukela for typing the manuscript so efficiently. Of course, the author accepts sole responsibility for errors of fact or interpretation.

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Demand Characteristics for Vine Vegetables in Honolulu, Hawaii, 1947–1961

JERRY FOYTIK[1]

Prices for many fresh fruits and vegetables fluctuate widely even during fairly short time intervals. These variations occur at each level in the distributive channel—farm, wholesale, and retail. They result from the influences exerted by numerous factors. An empirical analysis of monthly price and quantity data indicates that changes in market supply are responsible for much of the variation in prices of vine vegetables. Furthermore, the net price-quantity relation shifts substantially and in a systematic fashion during the months of each season and from one year to the next.

The purpose of this report is to outline how this analysis was made, to present the results obtained, and to discuss their implications. It provides a basis for evaluating past changes in production and marketing practices and for considering further shifts in prospect for the immediate future.

The study is not oriented toward a direct consideration of consumers' demand as reflected by their behavior at the retail store nor of the price-quantity relation encountered by growers in disposing of their crop at the farm level. Rather, it attempts a statistical derivation of "demand" relations facing handlers who sell vine vegetables at the Honolulu wholesale market. Although not necessarily descriptive of theoretical demand curves, the findings provide insight into the actual behavior of terminal market prices.

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[1]During August 1962–July 1963 when this research was conducted, the author was Agricultural Economist at the Hawaii Agricultural Experiment Station and Visiting Professor of Agricultural Economics, University of Hawaii, while on leave from the University of California at Davis.

Specifically, this investigation is concerned with determining the principal factors responsible for variations in monthly wholesale prices during 1947–61. It deals with snap beans, cucumbers, and tomatoes. These three vegetables constitute the great bulk of all the vine and bush vegetables sold in Honolulu. They differ substantially in physical characteristics, in the sources from which supplies arrive, and in their use within the household. Nevertheless, the statistically derived price-quantity curves seem to be similar in several ways.[2]

A. PRELIMINARY CONSIDERATIONS

Some aspects of the Hawaii vegetable industry are of particular relevance to this price analysis. These are recapitulated here to indicate the character of the Honolulu wholesale market and the nature of demand for vine vegetables. Attention is also directed toward seasonal changes that take place in supply and price.

1. Role of the Honolulu Produce Market

The basic structure of the State's economy has a decided impact upon the marketing of vegetables, whether they are grown locally or come from out-of-state sources. Some of the more important characteristics should be mentioned, even though only briefly.

Hawaii, separated by over 2,000 miles from its nearest continental neighbors, is located on an island chain some 400 miles long. The State is fragmented further into numerous land islands created by high mountains and deep valleys. Its population is not large–less than 700,000 in 1962. Furthermore, the inhabitants are distributed unevenly over the land area of the State. Over 80 percent of the total reside on Oahu, the island where Honolulu is situated.

Honolulu, as the State's trading center for marketing produce, draws to its markets substantial quantities of the fresh fruits and vegetables grown on the Neighbor Islands. Only limited amounts of a few items grown on Oahu are shipped to these other islands. Practically all of the produce imported into the State comes to Honolulu.[3]

Since Honolulu is a "pocket" market for fresh fruits and vegetables, supplies cannot be augmented quickly when local production drops below

[2]Also compare with the results obtained for avocados, bananas, papayas, tangerines, and watermelons reported in a forthcoming bulletin: Jerry Foytik, *Demand Characteristics for Selected Fruits in Honolulu, Hawaii, 1947–1961,* University of Hawaii, Hawaii Agricultural Experiment Station, Agricultural Economics Bulletin No. 24, December 1964.

[3]As used in this report, "imports" refers to supplies reaching Hawaii from any sources outside the State and "exports" to supplies shipped from the State. Most produce shipments from continental United States or foreign countries to the outer islands go directly to the individual islands. In some cases the ships may stop at Honolulu first but there is little transshipment of produce from Honolulu to the other islands.

market needs and, conversely, local surpluses cannot be diverted readily to other markets. Hence, variations in market supply often lead to sharp price fluctuations. This is particularly true when Hawaii's output is markedly above or below average or when supplies from outside sources are cut off or sharply reduced because of shipping strikes or other transportation interruptions.

Although most vegetables can be grown quite successfully in Hawaii, commercial production of many falls far short of the State's needs. The relationship between local production and consumption varies widely from self-sufficiency in some items such as snap beans, burdock, eggplant, and watercress to substantial dependency on mainland sources for carrots, garlic, Iceberg lettuce, and dry onions. Supplies of vegetables (excluding potatoes) sold in the Honolulu wholesale market come in about equal quantities from three sources: Oahu production, Neighbor Islands shipments, and continental United States imports.

Hawaii vegetable farmers supply local needs inadequately for various reasons. There are production problems associated with the State's semitropical climate and the topography of land available for vegetable production. Most vegetable farms are quite small, averaging only 4.7 acres, which hinders the introduction of cost-reducing techniques of productions. Competition from mainland sources is substantial. Farmers are aware of the dangers involved in oversupplying the Honolulu "pocket" market and are willing to have some inshipments of supplies so that selling prices reflect transportation costs from the Mainland. The State's geographic isolation and population distribution make transportation an important factor. Farmers must import a large proportion of the inputs used in production, thus incurring relatively high freight charges. Motor trucks cannot be used to haul supplies to Honolulu except from growing areas located on Oahu. Air and surface transportation result in added expense and added delay, respectively, in moving produce to the major market. Coordination between farmers and wholesalers is poor because a relatively large number of wholesalers handle produce.

For these and other reasons vegetable production is not a major enterprise in Hawaii. Commercial production is limited to 3,600 acres, about 1.2 percent of the total in all crops. In contrast, California acreage is (in decreasing order of importance): 175,000 for tomatoes; 125,000 for lettuce; 75,000 for asparagus; etc. Hawaii farmers produce vegetables almost exclusively for fresh use within the State. Only small quantities of specialty vegetable items (e.g., fresh ginger and lotus root) are shipped out of the State; processing is limited to Oriental-style pickled products.

The wholesale produce market in Honolulu includes two distinct and separate locations, both of which are poorly situated as to accessibility and space. Produce moves through the market in a simple and direct manner. However, the market structure is characterized by small-scale and service-type operations. For example, Honolulu wholesalers continue to regrade and repack locally grown produce, to make frequent deliveries, and to

provide liberal terms of credit. Commission selling is customary for fruits and vegetables produced in the State, whereas very little imported produce is shipped to Hawaii on consignment. The conventional wholesaler has lost ground in recent years to direct buying by retailers. Direct buying is most apparent for imported produce.

Until the close of World War II, food retailing in Hawaii was dominated by the small, service-type independent store, usually operated by the owner and his family with a minimum of hired help. This independent operator purchased supplies from conventional wholesalers. Since then, food retailing has undergone important and rapid changes. Possibly the most significant of these, particularly on Oahu, is the rapid growth in mass merchandising occasioned by the rise of supermarkets to a dominant position.

2. Marketing Vine Vegetables in Honolulu

Honolulu deliveries of the three major vine vegetables originate in different growing areas. Snap beans are largely produced on Oahu, with about 10 to 12 percent coming from the Neighbor Islands and none from out-of-state sources. Generally half of the cucumbers come from Oahu production and half from the other islands. The source of tomato supplies is changing quite sharply. At present about 50 percent come from Neighbor Islands, 30 percent from mainland sources, and 20 percent from Oahu production. This is in sharp contrast to the situation only a few years ago (1952–56 average) when the relative importance of these sources was about 30, 20, and 50 percent, respectively.

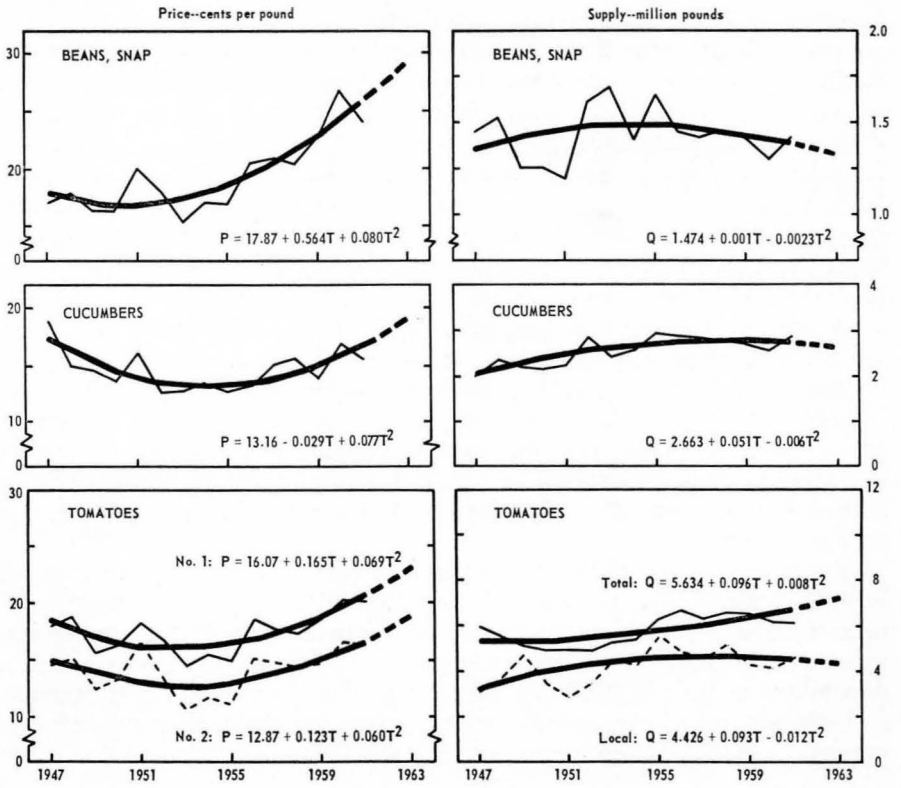
The three vegetables mentioned represent practically the total supply of vine vegetables. About 60, 23, and 12 percent of the total volume consist of tomatoes, cucumbers, and snap beans, respectively. The others (greens peas, pumpkin, and squash) comprise only 5 percent of the total. The relative importance of minor vine vegetables declined somewhat during the past 15 years. Season prices and market supplies for 1947–61 are plotted in figure 1. Parabolic trends give reasonably good fits for each price and quantity series.

Each price trend declined somewhat until the early 1950's and then increased. Each trend rose by about 21 percent during the first 6 years after reaching its minimum and by 45 percent during the first 9 years.[4] Movements of the two tomato price series were almost identical, except that the parabola was slightly flatter for No. 2 than for No. 1 price. Hence, the price ratio varied within a very narrow range—from 80.1 to 81.5 percent—throughout the 1947–61 period.

Long-run changes in annual supply generally moved in a direction opposite to that of price trends. For total supplies of snap beans and cucumbers and for tomatoes supplies from Hawaii production, the trends

[4]The percentage increases varied from 19.7 to 22.5 and from 42.3 to 46.5 for the 6-year and 9-year periods, respectively.

FIGURE 1. Vine vegetables: Honolulu wholesale price and supply, annual, 1947–61.



NOTE: In the trend equations, T is time measured in years from 1954. Price is for No. 1 grade and supply is the total market supply except as noted for tomatoes in bottom panels.

Based on tables A-1 to A-9 and B-2.

increased (though not very rapidly) until the mid or late 1950's and then declined. Because of this decrease in recent years, the trend declined to its 1947 level by 1961 for snap beans. It will reach the 1947 level in about 1969 for cucumbers and locally produced tomatoes—assuming that the presently fitted parabolic trends continue to be reasonably good descriptions of annual supply changes, on the average, during the next several years. A different situation prevailed for imported tomatoes. The trend for such supplies declined sharply until 1954 and then increased considerably. Hence, total supplies of tomatoes at Honolulu followed a different pattern from the trend for snap beans and cucumbers. The trend reached a minimum in 1948 and increased, on the average, during subsequent years.

Deliveries to Honolulu of vine vegetables as a group have been increasing for many years but only two-thirds as rapidly as deliveries of other vegetables. Since 1957, vine vegetables declined slightly in relative importance–from 23.5 to 22.5 percent of the total.[5]

Figure 2 indicates that seasonal variations in wholesale prices for the major vine vegetables are negatively correlated with monthly changes in supply during 1947–61. Usually, prices for snap beans and cucumbers are above the season average by 10 percent in November–December and by 35 percent in January–March, and are below the average by 25 percent in April–June and by 10 percent in July–October. Fluctuations in monthly supply of snap beans and of cucumbers are smaller in magnitude. Seasonal shifts in tomato prices and supplies follow a similar pattern but they are less pronounced and occur somewhat later in the year.

Monthly variations in prices and supplies have not changed much during the past 15 years–see figure 3. It is true that the relative importance of various months changed, especially in the case of supply. Differences between averages for the three 5-year periods, however, are not excessively large relative to year-to-year fluctuations. Thus, during the 1947–61 period (1) the seasonal distribution of supplies was not altered appreciably, at least not in a systematic fashion, and (2) the seasonal price pattern was changed even less.

Prices for No. 1 and No. 2 tomatoes had very similar seasonal variations as well as similar annual trends during 1947–61. On the other hand, supplies from island production and mainland sources do not have similar seasonal distributions. Tomatoes are imported in larger or smaller quantities depending on the plentifulness of locally produced tomatoes. For example, only 10 percent of the annual imports arrive during April–June when 30 percent of the local crop is marketed.

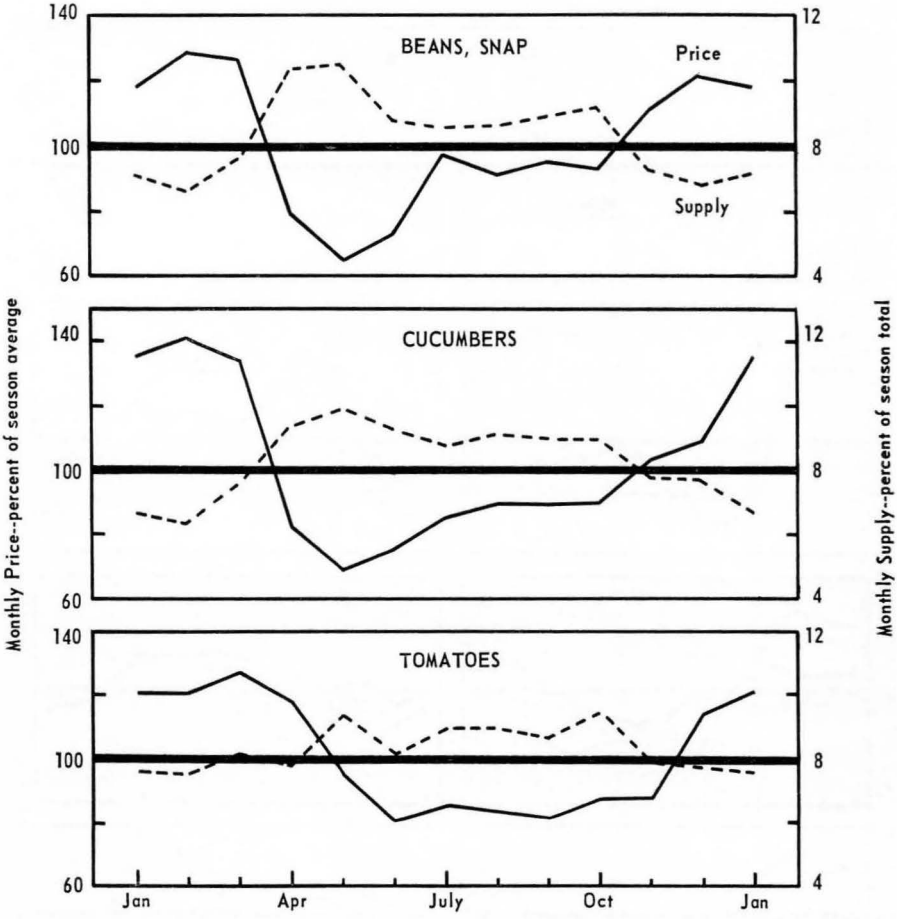
3. The Problem of Temporal Demand Shifts

The price-quantity relation may not remain constant over time because numerous factors operate to determine the nature of demand prevailing at any given time. Their aggregate effect may change significantly so that the level or slope of the demand curve shifts temporally. These factors may be grouped into three categories according to the demand changes they induce.

Some shift variables change demand in a reasonably regular fashion on a seasonal basis. Month-to-month changes in weather conditions may result in seasonal variations in the product's quality and in consumer preferences and eating habits. The population served may expand and contract seasonably with changes in the number of residents away on vaca-

[5]Annual data and parabolic trends for Honolulu deliveries of fresh fruits and vegetables, by groups, are given in Appendix A-1.

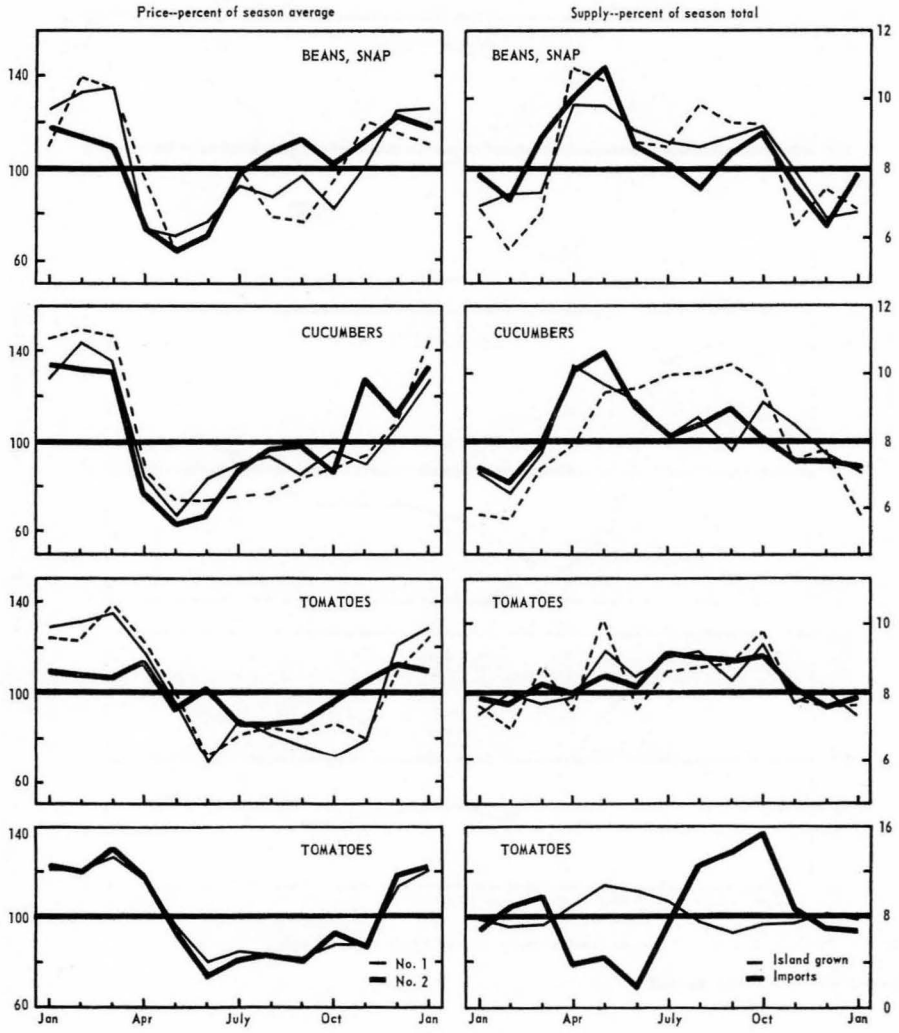
FIGURE 2. Vine vegetables: Seasonal price and supply at Honolulu wholesale market, 1947–61 average.



NOTE: Price is for No. 1 grade and supply is the total market supply.

Based on tables A-1 to A-7.

FIGURE 3. Vine vegetables: Honolulu wholesale price and supply, monthly, 1947–61.



NOTE: Five-year averages are shown in the top three panels:

------1947–51 ———1952–56 ———1957–61.

The bottom panels compare (1947–61 averages for tomatoes) No. 1 with No. 2 prices and Island-grown with imported supplies.

Based on tables A-1 to A-9.

tion and of tourists visiting Oahu. There may be monthly changes in other factors, such as the supply (and sales) of competing (or supplementary) commodities, the quality of these products, employment and income levels, number of lunches served at school cafeterias, and so on.

Demand may also change smoothly and slowly over longer periods of time in response to regular, long-term movements in several factors. The population included within a market grows and its composition is altered, e.g., as to age, family size, marital status, occupational classification, ethnic composition, and degree of urbanization. Income (or purchasing power) changes on a per capita basis and in terms of its distribution among consumer groups. Secular changes also occur (or may occur) in marketing methods, availability (and prices) of competing commodities, quality of the product under study and of its substitutes, consumer tastes and preferences, and many other factors.

Trend shifts in the demand for fresh vegetables sold at the Honolulu market could arise from several causes. The data tabulated in tables B-5 and B-7[6] (as well as information on other indices that might have been included) generally indicate substantial increases in economic activity in Hawaii since about 1950 following several years during which activity increased slowly or even decreased. A few examples will serve to indicate the magnitude of changes which took place. The State's civilian population and per capita income (in real terms) declined after World War II and then increased by 35 and 30 percent, respectively, since 1950. Honolulu sales of fresh vegetables changed at about the rate of population growth compared to a much greater increase for frozen vegetables.

Seasonal and trend changes in demand take place in a fairly predictable fashion in response to fluctuations occurring regularly within specified time intervals and to variations resulting from a long-run tendency for growth or decline. Demand also may change because the influence of one or more factors changes suddenly. An abrupt change in demand for a particular commodity may arise because its quality is unusually good or poor due to variations in weather conditions or to other causes. Erratic demand shifts are produced by such other factors as the introduction of a new product on a large scale, a sharp increase or decrease in the supply of competing products, or a drastic change in marketing methods.

Changes in military purchases from Honolulu wholesalers must also be examined. Since data on monthly purchases during the entire 1947–61 period are not available, it is desirable to determine the magnitude of such purchases and whether they are approximately in proportion to civilian purchases. Only fragmentary information is available for making this comparison. The data available suggest that military purchases change substantially from month to month and that such shifts are not made in a systematic manner.

[6]Tables A-1 to A-9 and B-1 to B-10 are in the Statistical Appendix.

TABLE 1. U.S. Armed Forces requirements for ten major fresh vegetables in Honolulu, Hawaii, 1962

VEGETABLE	LOW MONTH	HIGH MONTH	AVERAGE MONTH	STANDARD DEVIATION	COEFFICIENT OF VARIATION	PROPORTION OF SUPPLY[a]
	1000 pounds				*Percent*	
Lettuce, all	76.5	104.8	89.1	8.23	9.2	16.6
Tomatoes	50.5	80.8	64.0	8.18	12.8	11.5
Cabbage, head	38.3	65.2	53.0	8.41	15.9	8.7
Onions, dry	25.9	50.5	40.6	7.56	18.6	6.7
Celery	26.8	43.4	34.9	5.98	17.1	13.5
Carrots	21.8	39.0	29.0	5.74	19.8	10.7
Cucumbers	13.6	30.0	23.9	4.07	17.0	9.5
Peppers, sweet	11.6	20.4	15.5	2.72	17.5	21.0
Radishes	7.3	10.9	9.0	1.11	16.1	n.a.
Onions, green	6.6	10.8	8.2	1.15	14.0	11.1

[a]Military requirements for 1962 divided by total supply on the Honolulu wholesale market, expressed as percentage.

Source: Based on information from Hawaii Crop and Livestock Reporting Service *Hawaii Agricultural Production*, issues for November 1961 and February, May, and August, 1962.

TABLE 2. Navy purchases of fresh vegetables from Honolulu wholesalers, 1953-59

VEGETABLE	LOW YEAR	HIGH YEAR	AVERAGE YEAR	STANDARD DEVIATION	COEFFICIENT OF VARIATION	PROPORTION OF SUPPLY[a]
	1,000 pounds				*Percent*	
Lettuce, all	237	647	450.0	126.8	28.2	8.8
Tomatoes	344	745	531.3	138.6	26.1	8.7
Cabbage, head	239	575	435.6	111.2	25.5	6.8
Onions, dry	140	358	257.9	78.3	30.4	3.8
Celery	23	514	355.0	157.8	44.4	11.2
Carrots	119	246	159.3	53.8	33.8	5.1
Cucumbers	107	201	155.0	33.4	21.5	5.7
Peppers, sweet	85	172	114.1	26.5	23.2	1.6
Radishes	46	98	73.6	18.1	24.6	n.a.
Onions, green	53	112	75.1	17.4	23.1	1.7

[a]Navy purchases (1953-59 average) divided by total supply on the Honolulu wholesale market, expressed as percentage.

Source: Based on unpublished data.

For example, 1962 requirements of the U.S. Armed Forces for ten major vegetables ranged from 7 to 21 percent and averaged 12.2 percent of the total supply on the Honolulu wholesale market—see table 1. This quantity represents a substantial proportion of the total. Furthermore, requirements varied considerably on a monthly basis—from lows of 57 to 86 percent of the average month to highs of 118 to 134 percent. On the average, the variation ranged from 75 to 126 percent.

Table 2 gives actual purchases by the Navy for the same ten vegetables. These data (for 1953–59) indicate that annual purchases fluctuate much more than do monthly requirements. This may be due, at least in part, to a tendency on the part of wholesalers to maintain prices on regular sales when markets become glutted by dumping surpluses on the military, even at much lower prices.

This enumeration gives a partial list of factors accounting for temporal changes in demand. It indicates that the analyst should expect the demand for many vegetables sold fresh on the Honolulu wholesale market to shift in a systematic fashion during the season and to undergo a trend change over a period of several years. In addition, he should expect some discontinuities in the demand changes corresponding to random disturbances.

B. METHOD OF ANALYSIS

The rationale of the empirical approach employed, the nature of the data used, and the general methodology followed are discussed below without elaborating on details which can be explained more appropriately as the analysis is presented.

1. Rationale of the Empirical Approach

The problem considered is one of describing the demand function facing sellers at the Honolulu wholesale market. The demand function relating price received to quantity sold can be formulated in two different ways. The distinction between the two types of demand must be kept clearly in mind.

The theorist's concept is of a hypothetical relation. It summarizes for a particular instant of time various alternative quantities that buyers would purchase at different prices when the influence of all other relevant factors is held constant. The statistically derived demand function, on the other hand, is a historical relation. It expresses how average quantity and average price were related during a particular past period after allowing for the effect caused by changes in such other variables as are introduced explicitly into the analysis. The two functions are different. They do not necessarily yield the same relationship.

This study is designed to derive the statistically derived demand function. By summarizing the average historical relation, the *ex post* demand function does relate to the demand side of the market. It gives consider-

able insight into how the pricing mechanism operated during the period under study. It can offer some guidance concerning the immediate future beyond merely supplying an estimator for the statistician's use in making forecasts—providing the original observations are sufficiently numerous and representative, and providing market structure and conduct do not change drastically.

The fundamental hypothesis made in this empirical study is that the unknown *ex post* demand function can be approximated by a more or less simple equation obtained empirically by an analysis of the available statistical data. Specifically, this implies that:

(1) A routine of demand exists so that the relations remain stable instead of being unduly disturbed by changes in other factors such as population composition, income distribution, and consumer preferences.

(2) This routine can be revealed because the available observations are sufficient in number to give a series of equilibrium points.

(3) The important factors producing shifts in demand can be enumerated and measured satisfactorily, by considering the theoretical aspects of the problem, information about the commodity and its marketing, and "noneconomic" factors.

(4) Suitable hypotheses to be tested can be developed to express the type of expected relations and *a priori* expectations as to signs and relative magnitudes of parameters.

(5) Adequate methods can be prescribed for testing the hypotheses.

These assumptions are fulfilled only partially by this investigation. They are stated explicitly in order to emphasize that the results obtained must be interpreted with caution. Although these matters cannot be discussed thoroughly here, some comments seem essential.

The first problem to be considered is whether the price-quantity relation revealed by the available statistical data is a demand function. A theoretical demand function is traced out if that curve remains fixed while the supply curve shifts. In the case of fresh vegetables the supply curve does shift from time to time in response to changes in crop conditions and other factors. However, the demand curve cannot be assumed to remain fixed. Yet it seems plausible that the supply curve is subject to greater random shifts than is the demand curve. However, even if both curves shift, as appears likely, the parameters of the demand function can be approximated, if the form of the demand function and the complete set of shift variables are known. Although this information is not available, a useful *ex post* demand function can be obtained from a detailed empirical study of the data.

A related question may be raised: "Is it possible, by statistical analysis of data not experimentally controlled, to derive a demand function at one

stage in the marketing process without taking into account the relations prevailing at other marketing levels?" It can be argued that the forces operative at the various levels are definitely interrelated and that the wholesale market occupies a central position in the system used for marketing fresh vegetables in Honolulu.[7] If this view is accepted, the relation derived for the wholesale market can be used for approximating appropriate demand functions at retail and at the farm by making proper adjustments for the retailer's markup and for marketing costs incurred in moving supplies from the grower to the wholesaler.

By using monthly data extending over a period of several years, a large number of observations become available. The number should be sufficient to reveal the routine of demand that existed on the wholesale market during the period under study.

Major shift variables can be identified. All of these, however, are not introduced into the analysis. Some cannot be measured satisfactorily. Others, though measurable, are omitted for various reasons, as indicated in Section B-3.

Alternative hypotheses can be developed as to types of relations and parameter values to be expected. Frequently, it is held that procedures for testing such hypotheses are not available because those developed for making an inference statement are not applicable to time series data since repeated drawings from the universe are not possible. The possibility of making any analysis is precluded, if the time sequence of observations is assumed to be completely unique. An alternate and defensible view can be taken which permits statistical inferences to be made from analysis of time series data.[8]

2. Hypothesis Tested

Monthly prices can be expressed as a function of quantity and of the shift variables in several ways.[9] Each separate formulation implies a specific hypothesis as to how the influences effect changes in the price level. The approach followed here considers all monthly observations as an entirety, uses a generalized formulation, and determines whether systematic changes in the regression lines are present. Shifts in the net price-quantity relation are secured by introducing "month" as a separate independent variable. The equation might be of the form:

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[7]Wholesalers buy produce merely as intermediary handlers for resale to retailers, who, in turn, distribute it to consumers. The price bids made by wholesalers represent their estimates of the retail price-quantity relation and of the retailer's markup. Wholesale demand is determined by the same forces, operating in approximately the same manner, as those influencing retail demand. Hence, the statistical derivation of the wholesale demand function can be attempted without specifying the forces involved at other points of the distributive system.

[8]Generally, a single observation is regarded as an element and its repetition as generating a population. In the same way the result of an experiment (as, for example, a price analysis) can be viewed as one observation from a population of such experiments.

[9]See Note 1, Methodology Appendix, for a discussion.

$$P = f(Q) + g(M) + h(X_1, X_2 \ldots),^{10}$$

where P, Q, and M denote, respectively, monthly price, monthly quantity, and month of the season; X_1, X_2, . . . represent other shift variables.

This equation restricts demand shifts to a well-defined, smooth pattern. The view that the underlying relation can be so described is defensible if the forces producing the shifts may be assumed not to change the magnitude of their influence abruptly. This assumption is made here.

3. Variables Used

Price is taken as the dependent variable for two main reasons. The empirical study is designed to "explain" fluctuations in wholesale prices by indicating the average or expected price corresponding to any set of values assigned to quantity and the other independent variables. This does not imply that causation necessarily flows from quantity to price rather than conversely. An appeal to the market structure, however, suggests that a plausible argument can be advanced for this type of cause-and-effect connection since wholesale prices are dependent upon the quantity offered for sale instead of the reverse. But even more importantly, reliance is placed on the statistical argument that errors of measurement should be concentrated in the dependent variable. Apparently such errors are relatively larger for price than for quantity in the case of fresh vegetables marketed in Honolulu.

Only two shift variables are retained in the final equations: "month" and "year." Their use is necessary because the study attempts to determine the extent to which the net price-quantity relation changes seasonally and annually. These temporal factors give significant results. They serve as proxies for the combined effect of all omitted factors which produce seasonal and trend shifts, respectively, in the demand function.

Other variables were deleted from the study for various reasons. Some had to be omitted because satisfactory measurements could not be secured. For example, there is no information available (extending over a period of years) as to monthly changes in quality factors (grade, maturity, etc.), consumer preferences, sales of frozen vegetables, and certain other factors.

Consumer income or purchasing power was excluded for other reasons. Although data are gathered on various phases of economic activity in Hawaii, the information is not available in the detail desired. Rather than using this fragmentary data or data relating to the Mainland, it was decided to omit this factor entirely and to allow its influence to enter via the "year" variable. Although this procedure is contrary to that followed in many price analyses, it seems justified for this study. Presumably "year" and "income" are highly correlated for the period under study and, as a consequence, the "income" effect is reflected by the evolutionary changes

[10]This exposition is intended merely to indicate the procedure. Of course, the data used for fitting the equation may be either in actual values, their logarithms, or some deflated values. The equation set up may be arithmetic or it may represent a more complex relation secured by introducing curvilinearity and various joint effects.

included under "year." Furthermore, income has changed less sharply in Hawaii during recent years, especially in constant dollars, than is sometimes assumed.

Two other variables were introduced into the equation. Their use, however, proved fruitless in the case of vine vegetables and they were omitted in the final formulation. It was assumed that prices may be related to the supply of the preceding month as well as of the current month.[11] Possibly a month is too long a period for measuring the effect of prior sales on the current demand schedule. An attempt was made to measure the effect of variations in supply of competing commodities. Apparently, the trial-and-error procedure employed did not suffice for revealing an appropriate combination of other commodities that affect demand for individual vine vegetables.

4. Nature of the Price and Quantity Data

The series used are the data on wholesale prices and market supplies for fresh sales at the Honolulu wholesale market. Monthly data are used for two basic reasons.[12] They permit investigation of intraseasonal demand shifts. They accumulate 12 times faster than annual observations and, hence, provide a respectably large sample before underlying supply-and-demand conditions change much. These series are believed to be sufficiently accurate to yield acceptable results for the price analyses attempted. Their usefulness and limitations are indicated by the following description of the data.

Wholesale prices for fresh fruits and vegetables are collected twice weekly (on Tuesday and Thursday) by the Federal-State Market News Service. The quotations are determined subjectively by interviewing a cross section of wholesalers and relate to the portion of the supply grown within the State.[13] Usually, these quotations are expressed as ranges for "stocks of generally good quality in trucklot or part trucklot quantities sold to retailers and restaurants by wholesalers and producers." A simple average of the midpoints of these ranges for the Tuesdays and Thursdays of a calendar month is reported as the price for that month.

Honolulu market supplies are the sum of unloads from all sources (the Neighbor Islands and areas outside the State) and of estimated marketings from Oahu production. They exclude direct imports made by the Armed Forces but include military purchases from local dealers (used by the Armed Forces or sold in their commissary stores), quantities shipped from

[11]This procedure is equivalent to hypothecating that time markets are interdependent so that sales earlier in the season tend "to make or break" the market—i.e., that a large or small supply (relative to normal) during a particular month tends to lower or raise the level of demand during the succeeding month. This thesis is frequently advanced by vegetable producers and wholesalers.

[12]Weekly data might be better but they are not available on market supply.

[13]Grade standards are established by Hawaii for almost all vegetables produced locally. Monthly prices are reported for Hawaii No. 1 and No. 2 grades of tomatoes and only for No. 1 grade of other vegetables.

Honolulu (to other islands and to the Mainland), and small amounts entering processing outlets.

The price and quantity data contain certain measurement errors. Furthermore, they are not entirely representative of monthly prices and sales of fresh vegetables sold for civilian use. This situation means that neither series is entirely satisfactory for use in determining price-quantity relations. These limitations need to be discussed.

Price quotations for individual days are not substantiated in any way. The midpoint of the quoted range may, of course, differ from the average that would be determined (even for a specified grade) from actual sales records. Discrepancies of 5 to 10 percent or more might occur fairly frequently. The averaging technique used for determining monthly prices tends to give an upward bias because of the negative correlation prevailing between price and quantity. This bias may be substantial during months in which prices vary considerably, as is likely when supplies do not move to market at a reasonably uniform rate. A single price for a designated grade is unrepresentative of price for all sales of a commodity when the quality composition of sales changes markedly during the season or from one year to the next. Such quality changes occur quite frequently.

Measurement errors in the quantity data arise in two principal ways. First, standard conversion factors are used in deriving the poundage equivalents of unloads received at Honolulu. Actually, the net weight of containers varies substantially, especially for supplies coming from sources within the State. Second, marketings from Oahu production, which consist of truck receipts to wholesalers and estimates of direct sales by producers to retailers, are subject to greater measurement errors. The part represented by direct sales is computed as a specified percentage of the estimated monthly production. This percentage is selected after interviewing producers and is not substantiated by sales records. Even if this procedure gives fairly accurate annual totals, it may result in substantial errors for monthly allocations. The importance of measurement errors arising from estimating Oahu marketings is correlated directly with the proportion of the total market supply represented by direct sales.

The quantity data have other limitations insofar as their use in this study is concerned. The analysis is directed toward deriving demand for monthly movement into civilian consumption. The quantity data, however, refer to supplies received at the wholesale market and reflect sales accurately only when wholesaler's month-end stocks do not change. Such inventory changes are relatively small (compared to monthly sales) for the more perishable items, and, hence, supply data are reasonably accurate indicators of actual sales. A greater discrepancy arises from the fact that some supplies are sold to the Armed Forces. Military purchases from local wholesalers are substantial for some vegetables. Of more significance to the analysis is that such purchases vary considerably over time—both seasonally and annually—so that their relative importance does not remain constant, or even approximately so.

5. Procedure Followed

The period covers 1947–61. Data for earlier years are omitted from the analysis since they relate to a situation deemed unduly disturbed by war conditions and price control. Data for 1962 are excluded since they were not available when the relations were determined. Subsequently, however, monthly data relating to 1962 became available. These were substituted into the regressions to secure an indication of how well the formulations apply to 1962.

Conventional equations are used for expressing price as a function of quantity and the shift variables. The underlying relations are assumed to be curvilinear. This approach leaves unanswered the problem of specifying the proper curve to be used. Insofar as possible, simple curves are fitted.[14]

In conformity with theory, demand is expected to decline by progressively smaller amounts as quantity increases. Several mathematical equations can be set up to describe this situation. The parabola is a suitable approximation, providing it is convex to the origin and its minimum point is beyond the range of quantity values observed. Both conditions are met in these analyses and, therefore, the parabola is retained.

Curvilinearity also seems indicated for describing the "time" trend, which serves as a proxy for the combined influence of omitted annual variables. There is no theoretical base, however, for specifying the form of this curvilinearity. The method followed consists of using a simple parabolic trend if a linear one seems inappropriate and of introducing higher degree terms if, and only if, a simple parabola also does not suffice to describe the nature of annual shifts.[15]

Monthly demand shifts cannot be described by very simple equations. The relation derived should be such that the seasonal pattern is closed in the sense that the level indicated for the end of the season equals that for the beginning. A sine curve and a cubic parabola are two functions which can be used to accomplish this end. Both, however, imply more uniformity in changes from month to month than might be justified. Consequently, free-hand fits are gotten to represent monthly demand shifts. These are "forced" so that (1) the pattern is closed in the sense indicated and (2) the sum of shifts (positive and negative) totals exactly zero for the season.

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[14]Of course, the simplest relationship is a linear function. Linear relations might be specified on the assumption that the degree of curvilinearity may be slight within the range of observations used. This solution was not adopted here for two reasons. Preliminary explorations indicated that linearity would not suffice. Conceptually, it seemed preferable to introduce a curvilinear relation and see how much curvilinearity is indicated and then replace it with a linear function, if that seems justified.

[15]In the case of the three vine vegetables considered here, the author did not make this generalization, tempting as it is, as a way of reducing the standard error of estimate and, hence, of increasing the correlation coefficient. This point is discussed below when the results are presented.

Adjustors are not used in these analyses. Various deflators are used by some researchers as a means of reducing the number of variables used or because it is assumed that an economic justification exists for adjusting the original data. The number of observations available for this study is sufficiently large so that an additional variable or two can be accommodated without difficulty. There seems to be no rationale based on economic considerations for making adjustments.

In essence, the relations used mean that shifts in the demand schedule, as the independent variables assume different values, are constrained to parallel movement. Since curvilinearity is assumed for the net regressions of shift variables, however, the parallel shifts in demand are not confined to uniform amounts or rates per unit change in values of the independent variables.

Graphic correlation methods are applied to monthly price and quantity data for the 15-year period to obtain the net relations prevailing at the Honolulu wholesale market. The advantages, as well as drawbacks, of this approach are well known to research economists. They need not be discussed here. A real effort was made to avoid the pitfalls.[16]

The analysis, at least in its early stages, is carried out on the basis of 5-year periods. If, as is true for vine vegetables, results for the three short periods seem to be consistent, then data for all 15 years are pooled in order to provide a better basis for determining the trend effect. This step involves a considerable amount of judgment and may be a real source of disagreement in interpreting results. It is readily admitted that by getting net relations separately for each 5-year period the results are different from those for all 15 years—and incidentally higher correlation coefficients are secured. If, however, the differences are not statistically significant, the relations for the totality of observations seem preferable, particularly since this procedure provides a much better basis for isolating the trend shifts.[17]

In one sense this procedure is quite flexible. Graphic determinations permit considerable leeway as to the relative importance attached to different observations (especially to the "unusual" ones), the forms of the functions, and so on. At the same time the procedure is fairly rigid—e.g., in the use of parabolic demand and trend functions and in specifying parallel demand shifts. Nevertheless, it serves as a convenient starting point. Although other functions may fit the data as well, or even better, no satisfactory way is presently available for choosing from the alternates available the particular function that should be specified. This, of course, is not a peculiarity of this study or of the graphic approach employed. It is an

[16]One of the greatest of these is the temptation of introducing extra "wiggles" into the curves since these serve to increase the correlation coefficient. Although values of this coefficient are computed, they are not considered to be a major reason for changing the form of the net regressions.

[17]There are no procedures for testing, statistically, the significance of such discrepancies. Hence, the determination rests on a subjective basis.

obstacle also encountered in making other price analyses and in using mathematical methods.

C. RESULTS OBTAINED

Several formulations, expressing wholesale prices of each vine vegetable as different functions of the independent variables, were fitted to the data. Generally, they gave equally good empirical fits, in the sense that the correlation coefficient had about the same value for the different equations. Considerations of simplicity, economic theory, and the nature of the commodities served as guides in the choice of the final functions.

The results express monthly wholesale prices as simple functions of supply and two temporal shift variables for each of the three vine vegetables. After the individual results are discussed they are compared and examined further.

1. Snap Beans

An adequate description of the price-quantity relation prevailing during 1947–61 is portrayed in the three panels of figure 4.[18] The relation includes major factors affecting changes in monthly wholesale prices on the Honolulu market. It does not contradict expectations as to direction of influence deduced from theory and acquaintance with the commodity and its marketing. This final relation may be written in equation form as follows:

$$(1)\quad P = 37.00 - 17.5Q + 1.4Q^2 + 0.555T + 0.0542T^2 + f(M),$$

where P is monthly wholesale price in cents per pound,
Q is monthly wholesale market supply in 100,000 pounds,
T is "time" measured in years from 1954, and
f(M) is the monthly effect, as shown in table 3.

Several facts of considerable interest and importance emerge. The net regression of price on quantity is negative in agreement with expectations. It is almost linear in shape. The slight curvature indicated for the parabolic fit, however, is in the direction to be expected. Hence changes in quantity are inversely correlated with progressively smaller price changes as supply is increased. For example, changes of 10,000 pounds in monthly market supply are associated, on the average, with opposite changes of 1.61, 1.33, and 1.05 cents per pound, in the wholesale price when supply is at 50,000, 150,000, and 250,000 pounds, respectively.

The "time" trend, serving as a proxy for the net effect of omitted variables, is approximated by a parabola. It reaches a minimum in 1948 and,

[18]In figures 4, 5, and 6 the same price scale is used in the two bottom panels so that the relative importance of seasonal and trend shifts in demand can be compared more easily. A different scale is used in the top panel.

Table 3. Vine vegetables: Results for regression analysis of monthly data, 1947–61

ITEM	BEANS, SNAP	CUCUMBERS	TOMATOES
Coefficients[a]			
A	37.00	26.57	29.82
B	–17.5	–7.90	–4.40
C	1.4	0.8	0.3
Monthly shift[c]			
Jan.	1.2	3.2	2.6
Feb.	2.0	4.0	3.6
Mar.	2.9	3.2	3.8
Apr.	0.2	–1.2	2.6
May	–3.1	–3.2	–0.7
June	–3.9	–2.8	–2.5
July	–0.9	–1.9	–3.0
Aug.	–0.1	–1.1	–3.0
Sept.	0.1	–0.7	–2.6
Oct.	0.3	–0.4	–1.8
Nov.	0.5	0	–0.4
Dec.	0.8	0.9	1.4
Price flexibility λ[d]			
1947–51	0.888	0.598	0.698
1952–56	1.078	0.757	0.464
1957–61	0.734	0.657	0.355
Quarter 1[f]	0.625	0.479	0.343
Quarter 2	1.062	0.905	0.399
Quarter 3	0.696	0.731	0.414
Quarter 4	0.621	0.607	0.399
Annual shift[b]			
1947	–2.24	0.24	1.87
1948	–2.39	–0.20	0.76
1949	–2.43	–0.53	–0.15
1950	–2.36	–0.77	–0.87
1951	–2.19	–0.90	–1.40
1952	–1.90	–0.98	–1.73
1953	–1.51	–0.96	–1.86
1954	–1.01	–0.84	–1.81
1955	–0.42	–0.63	–1.56
1956	0.32	–0.34	–1.11
1957	1.14	0.05	–0.48
1958	2.07	0.53	0.35
1959	3.12	1.09	1.38
1960	4.27	1.75	2.60
1961	5.53	2.49	4.01
1962	6.89	3.32	5.62
Demand elasticity $(1/\lambda)$[e]			
1947–51	1.126	1.673	1.434
1952–56	0.928	1.322	2.156
1957–61	1.363	1.521	2.818
Quarter 1[f]	1.601	2.088	2.914
Quarter 2	0.942	1.105	2.508
Quarter 3	1.436	1.368	2.416
Quarter 4	1.610	1.646	2.508

[a] Equations (1), (2), and (3) with trend and seasonal effects set at zero. These are of form: $P = A + BQ + CQ^2$, where P is price in cents per pound and Q is supply in 100,000 pounds.

[b] These values, shown in middle panels of the charts, are determined from $P = -1.011 + 0.555T + 0.0542T^2$ for snap beans, $P = -0.839 + 0.162T + 0.0448T^2$ for cucumbers, and $P = -1.809 + 0.153T + 0.0969T^2$ for tomatoes, where T is time measured in years from 1954. Adjustments are in cents per pound.

[c] Readings taken from graphically determined seasonal effects, as shown in the bottom panels of figures 4, 5, and 6. Adjustments are in cents per pound.

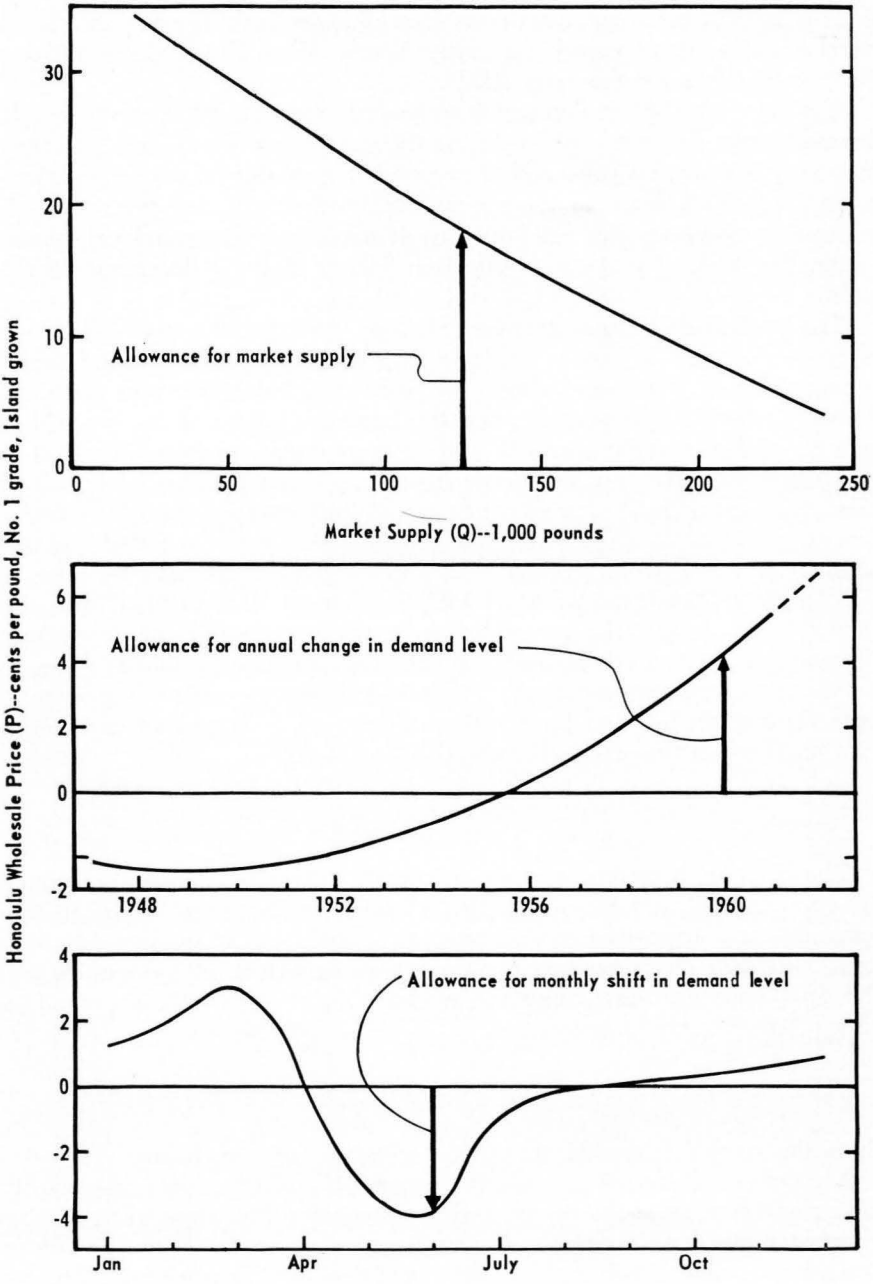
[d] Computed by the formula $\lambda = -\bar{Q}P' \div \bar{P}$ where $\bar{Q}$ is the average monthly quantity for the period, and the price $(\bar{P})$ and the derivative (P') are obtained by substituting $\bar{Q}$ into the regression equation.

[e] An approximation obtained as the reciprocal of price flexibility, using unrounded data. See Note 2, Methodology Appendix.

[f] The quarters listed are for the 1957–61 period.

Source: Computed as indicated using data in appendix tables.

FIGURE 4. Beans, snap: Estimated wholesale price with variations in supply, year, and month, 1947–61.



Based on equation (1) and table 3.

on the average, rises by an increasing amount in subsequent years—by annual increases of 0.07, 0.61, and 1.15 cents per pound in 1950, 1955, and 1960, respectively. The general movement conforms with expectations since indices of economic activity in Hawaii show both upward and downward changes immediately following World War II and then increase fairly regularly since the early 1950's.

The monthly shift in demand is quite pronounced. On the average, the demand curve declines rapidly during the spring months (March to June), rises very sharply by July, and increases fairly gradually until the following spring. This seasonal change in the level of the net price-quantity regression represents the net influence of numerous factors which operate within the cycle of a single season—see Section B for a discussion of this point.

The portrayal of these average relations, covering the period 1947–61, as given in figure 4, can be explained fairly simply. The demand curve, appearing in the top panel, shows the average relation between price and supply for the 15-year period, when the temporal influences of annual and monthly shifts are held constant at their respective averages. The bottom two panels indicate how much the historical demand curve is shifted by average changes in factors causing annual and seasonal price variations. For example, a monthly supply of 60,000 pounds is associated, on the average for the 1947–61 period, with a price of 27 cents; 120,000 pounds, with 18 cents. The trend value for 1960 is 4.3 cents (middle panel of figure 4), which means that the entire demand curve is raised by 4.3 cents from the average position for 1947–61. Allowances for monthly shifts (bottom panel) are interpreted similarly. Thus the demand curve is raised by 3 cents for March, lowered by 4 cents for June, etc., relative to its average level for the year under consideration.

2. Cucumbers

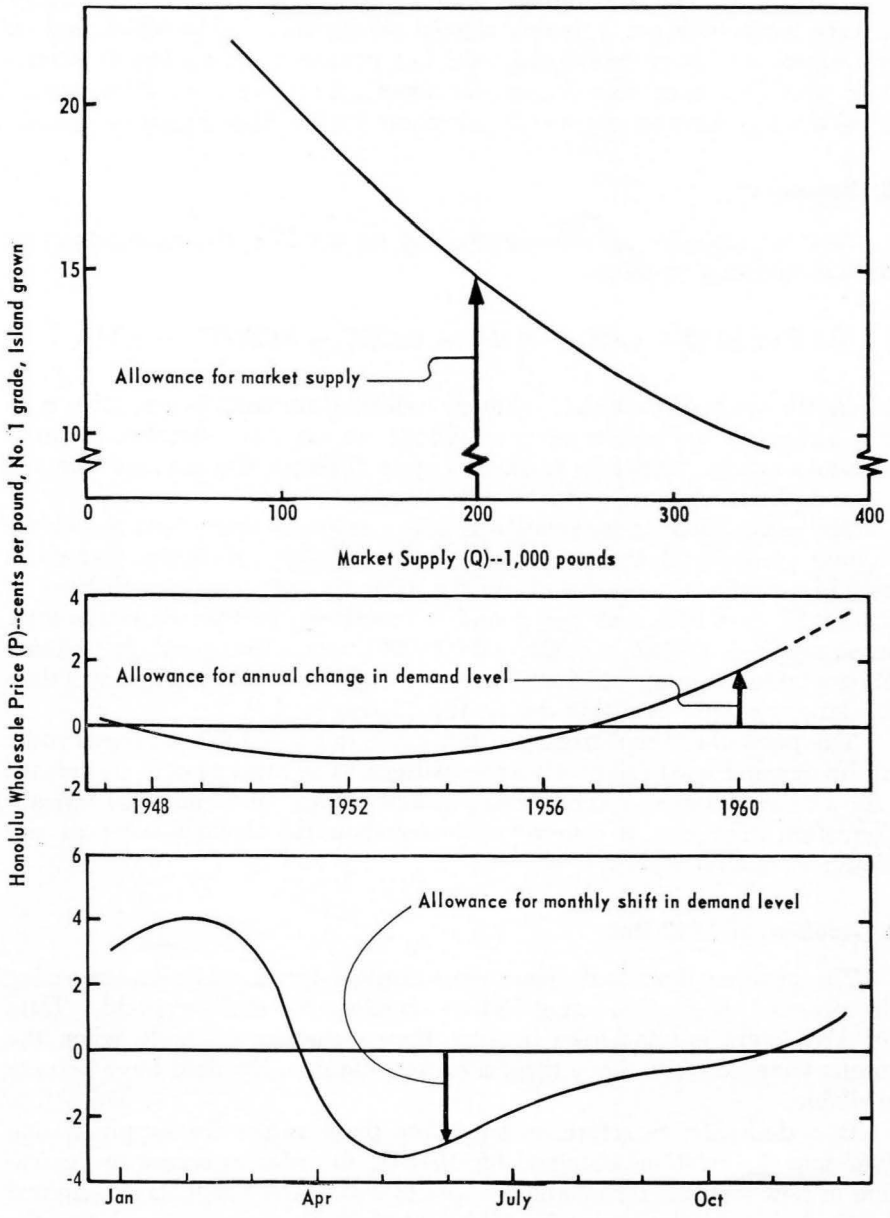
The relation between monthly wholesale prices of cucumbers on the Honolulu market and factors causing changes is shown in figure 5. The demand curve appearing in the top panel, and the allowances for temporal shifts are interpreted in the same way as indicated for snap beans. The final equation, describing the average historical relations prevailing during 1947–61, may be written as:

$$(2)\quad P = 26.57 - 7.90Q + 0.8Q^2 + 0.162T + 0.0448T^2 + f(M),$$

where the symbols have the meanings indicated for snap beans.

A parabola describes the net price-quantity relation. It is negatively sloping and convex to the origin, and in agreement with expectations. The progressive decrease in price change corresponding to larger quantities available on the market is shown by the following comparison. Changes of 10,000 pounds in monthly supply are associated, on the average, with

FIGURE 5. Cucumbers: Estimated wholesale price with variations in supply, year, and month, 1947–61.



Based on equation (2) and table 3.

opposite changes of 0.63, 0.47, and 0.31 cent per pound, respectively, in the wholesale price when supply is at 100,000, 200,000, and 300,000 pounds.

The "time" trend is parabolic, with a minimum in 1952. As the season advances the demand curve is shifted substantially. The peak upward movement is reached in February, the low point is in May. The February–May decline is more than 7 cents—or about 2.4 cents per month compared to an average increase of 0.8 cent per month for the May–February period.

3. Tomatoes

Average historical relations prevailing during 1947–61 are summarized by the following equation:

$$(3)\ P = 29.82 - 4.40Q + 0.3Q^2 + 0.153T + 0.0969T^2 + f(M),$$

where the symbols have the meanings indicated for snap beans. This relation includes major factors affecting changes in monthly wholesale prices of tomatoes on the Honolulu market. Figure 6 shows the average demand curve and the temporal shifts.

The net price-quantity relation is adequately described by a negatively sloping parabola of the proper concavity. Changes of 10,000 pounds in monthly supply are associated, on the average, with opposite changes of 0.26, 0.17, and 0.08 cent per pound, respectively, in the wholesale price when supply is 300,000, 450,000, and 600,000 pounds. This parabola becomes horizontal for a supply of 733,000 pounds—a quantity not much greater than the largest supply available during the 15-year period.

The parabolic "time" trend reaches a minimum in 1953. Seasonal shifts in the demand level follow a regular pattern. The movement is downward (for a total of almost 7 cents) from March to July or August and upward thereafter. The rise is somewhat slower than the decline—0.9 cent per month compared with 1.5.

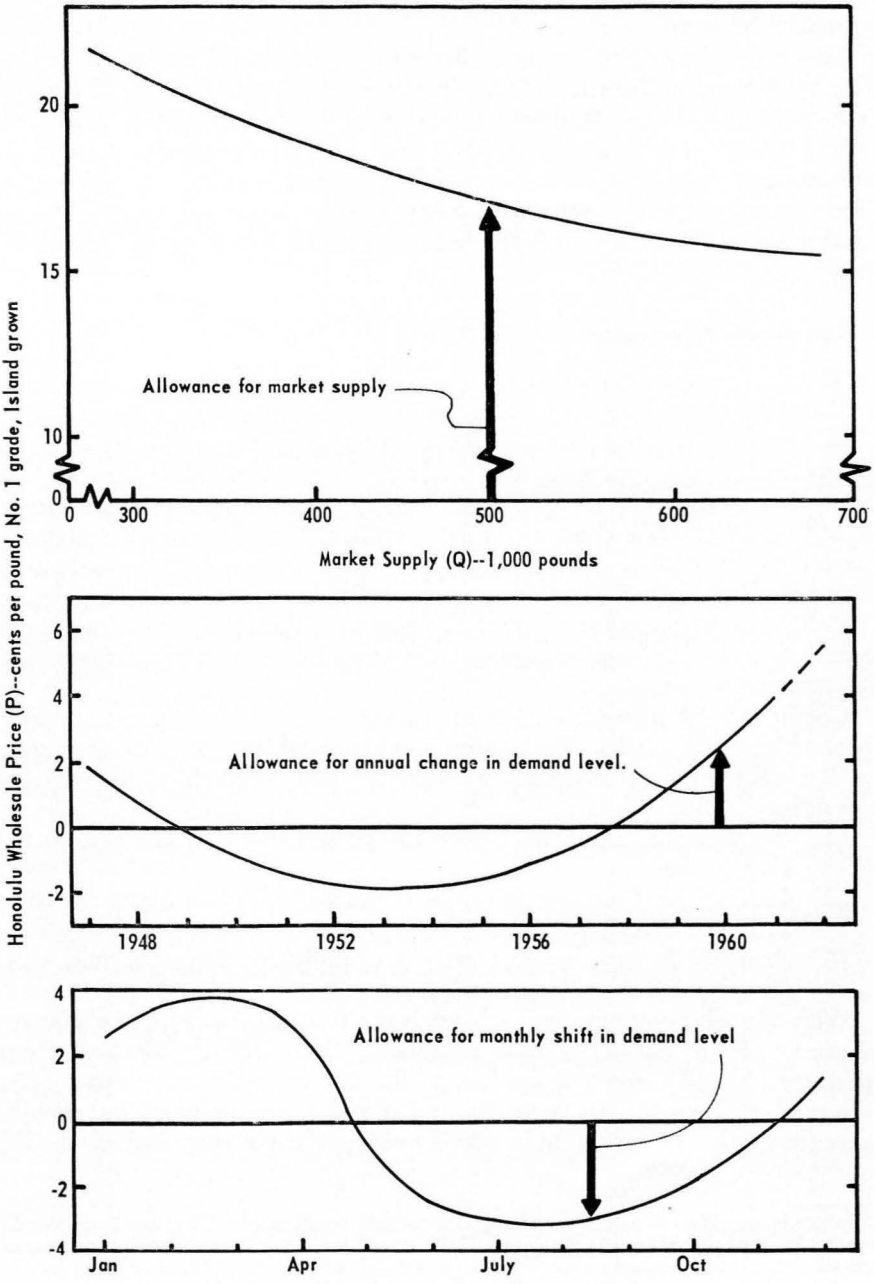
4. Addition of 1962 Data

The analyses described above were derived for monthly data covering the period 1947–61, i.e., using 180 observations for each vegetable. Data for 1962 were not included because they were not available when the results were derived. Since then, however, the monthly data have become available.

It is desirable, therefore, to substitute these values for supply during 1962 into the relations obtained for 1947–61 in order to secure an indication of how well the formulations apply to 1962. The residuals determined are included in the appendix tables along with those secured for the years covered by the analysis.

The derived equations generally indicate monthly prices for 1962 somewhat greater than those actually realized. The residuals, however, although

FIGURE 6. Tomatoes: Estimated wholesale price with variations in supply, year, and month, 1947–61.



Based on equation (3) and table 3.

generally negative, are not excessively large for snap beans and cucumbers —only two and one, respectively, are more than two times the standard error of estimate. Five of the 12 residuals for tomatoes, however, fall beyond this range.

As data for additional years of the 1960's are utilized, it should be possible to determine the cause of the negative residuals in 1962. It may be that conditions during this season were sharply different from those prevailing earlier. On the other hand, it may be that the results derived do not describe very well the relation which actually exists. A preliminary check seems to indicate that the annual shifts in the net price-quantity relations may increase to a lesser extent than indicated by the parabolic trends fitted for 1947–61.[19]

5. Comparative Summary

The final regression equations relate monthly wholesale prices by simple functions to three factors: (1) monthly wholesale supply, (2) a "time" trend, and (3) a seasonal shift. The relations derived for 1947–61, as summarized in the top portion of table 3, do not contradict expectations deduced from theoretical considerations. For each vegetable the net price-quantity relation is a convex parabola with slight curvilinearity and the time trend is a parabola having a minimum early during the 15-year period. Seasonal adjustments follow a more complex pattern. The shift in demand reaches a maximum point early in the season and declines to a minimum several months later—early summer for snap beans and cucumbers and late summer for tomatoes.

Coefficients of price flexibility and their reciprocals were computed.[20] These values tabulated in the bottom portion of table 3, indicate that, during 1947–61, the responsiveness of price (of vine vegetables) to changes in supply:

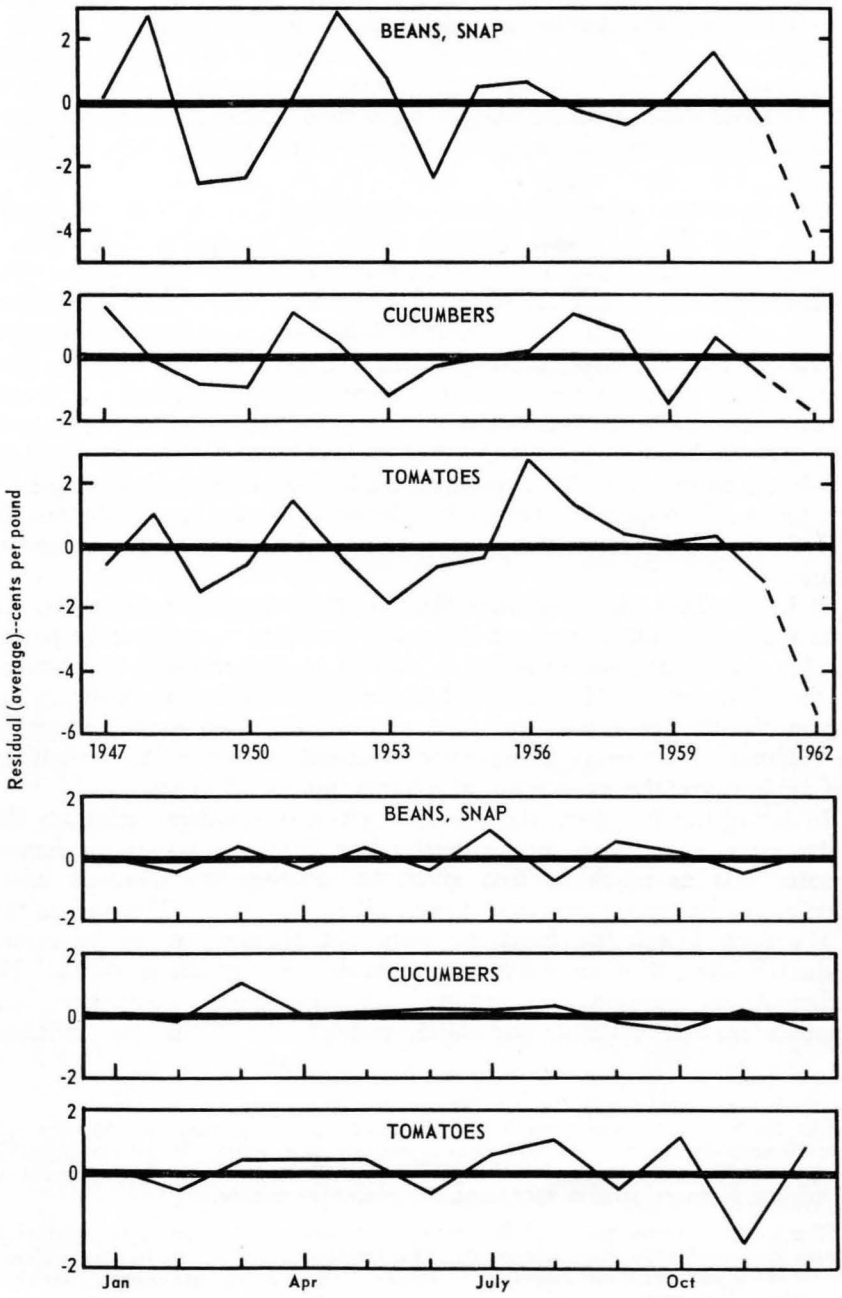
(1) was low for tomatoes, higher for cucumbers, and quite high for snap beans;
(2) declined for tomatoes throughout the period while first increasing and then decreasing for snap beans and cucumbers; and
(3) changed during the year only negligibly for tomatoes and considerably for snap beans and cucumbers.

With 180 observations for each analysis it is possible to make a careful study of the distribution of residuals. The residuals, derived from equations (1), (2), and (3) applied to the data given in appendix tables, were plotted about the net regressions of price on supply, year, and month. Averages of the 12 residuals for the months of each year and of the 15

[19]Undue importance should not be given to this comparison. The functions would have to be interpreted cautiously even if 1962 residuals had been smaller and more normally distributed about a zero value. Tables B-8 to B-10 indicate that residuals in several other years were as "unusual" as those for 1962.

[20]See Note 2, Methodology Appendix, for a discussion.

FIGURE 7. Vine vegetables: Plot of average residuals for 1947–61.



Based on appendix tables B-8, B-9, and B-10.

residuals for the years of each month are plotted, respectively, in the top three and bottom three panels of figure 7. The six scatter plots indicate a reasonably random distribution of residuals for the 1947–61 period as a whole. A similar result is secured for residuals plotted against supply—these charts are not included here. Apparently the residuals do not fall into any systematic patterns suggesting further adjustments in the regressions derived. However, attention needs to be called to two additional points.

The top panels show a substantial downward dip for 1962, following a decline from 1960 to 1961. Whether this result is significant depends on the cause for large negative residuals being secured for 1962. If they were produced by a large adverse effect of some factor not adequately covered by the analysis, then it may be that residuals for years of the immediate future will be distributed in a more normal fashion. It may well be, however, that the parabolic trends rise too steeply to the right and that a more gradual rise will be indicated as successive years are added to the analysis. It is not possible, of course, to indicate now which of these two possibilities is the more likely. This result certainly should serve as a warning so that too much reliance is not to be placed upon the trends derived for 1947–61 as a basis for making extrapolations for years in the immediate future.

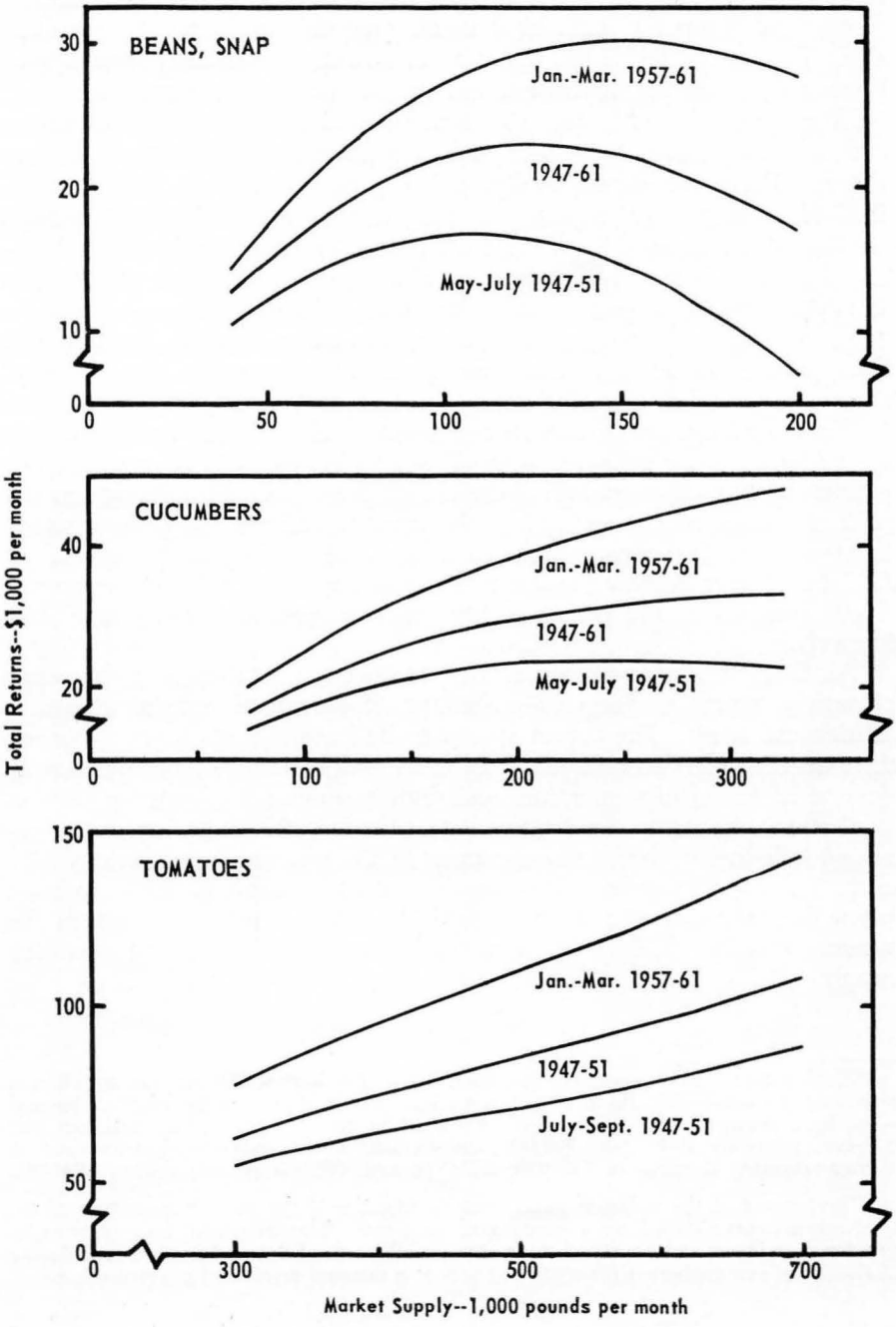
It is also desirable to examine the data to determine whether the patterns of seasonal shifts remained reasonably constant throughout the period. Possibly the easiest way to make this test is to plot monthly averages for the three subperiods—1947–51, 1952–56, and 1957–61.[21] The strongest suggestion of a change is indicated for tomatoes. But even for this vegetable the evidence is not overwhelming and clear-cut. It seems (to the author) preferable to use the same seasonal adjustments for all years.

In fitting the functions, the attention given to obtaining relations that might serve as a basis for understanding how the price mechanism operates was as much as that given to securing the relations which describe the particular past period covered by the study. This means that to a certain extent the functions were not changed so as to reduce residuals.[22] Yet it is of interest to consider the goodness of fit. The coefficients of correlation determined for snap beans, cucumbers, and tomatoes are 0.840, 0.810, and 0.675, respectively. Thus, the functions

[21]An alternate (and somewhat better) procedure is to determine a trend for each set of 15 monthly residuals considered as a separate time series. The seasonal pattern of demand shifts can be assumed to change over time, if the trends fitted are pronounced and indicate a general pattern with respect to successive months.

[22]For example, closer empirical fits are secured for each vine vegetable by making separate analyses for the three subperiods. This "improvement" results because different seasonal shifts and trend movements are obtained. These results are replaced by those applicable to the period as a whole, even though doing so increased the magnitude of residuals, because by subjective determination, it appeared that the variations in seasonal patterns and annual trends are not sufficiently large to warrant using them.

FIGURE 8. Vine vegetables: Total returns curves.



Source: Based on equations (1), (2), and (3).

fit the observations well for snap beans and cucumbers and less satisfactorily for tomatoes. On the average, during 1947–61, variations in market supply and temporal shifts in demand (monthly and annual) "explain" about 70 percent, R^2, of the variation in monthly wholesale prices of snap beans, 66 percent for cucumbers, and only 46 percent for tomatoes.

Equations (1), (2), and (3) can be used for deriving total returns curves corresponding to annual and seasonal effects held at any desired values. These are shown in figure 8 for three levels of demand: The 1947–61 average (all months) in comparison to the highest 3 months for 1957–61 (January–March) and the lowest 3 months for 1947–51 (May–July for snap beans and cucumbers, and July–September for tomatoes). The total returns curves are cubics since each is based on a parabolic price-quantity relation. They appear to be very dissimilar, however, because only those portions are shown which correspond to the range in quantity variations experienced during 1947–61.[23]

For snap beans each total returns curve reaches its maximum at about the midpoint of the relevant range of supply: 109,000, 128,000, and 151,000 pounds for the three periods indicated in the chart. This change in the position of the maximum reflects the upward shift in the price-quantity function from the summer months of 1947–51 to the winter months of 1957–61. Since, however, quantity has not increased, sales occur on the elastic segment of the price-quantity function more frequently now than formerly.[24]

All three total returns curves for tomatoes are positive over the range of supply generally marketed—indicating that demand remains elastic at all demand levels. The curves appear to be linear. Such, however, is not the case. Each has an inflexion point at its midpoint and is concave slightly downward for smaller quantities and slightly upward for larger quantities.

Cucumbers portray an intermediate situation. The total returns curve has an inflexion at almost the maximum of the relevant supply range. The curve remains elastic over this range at most demand levels. However, when the price-quantity function shifts to a low level (as it did in the summer months of 1947–51), demand becomes elastic for large monthly supply.

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[23]Each total returns curve is of the form $TR = AQ + BQ^2 + CQ^3$ and has an inflexion point at $Q = -B \div 3C$. Its location is not affected by a change in the level of demand —i.e., by a change in the value of A. For snap beans, cucumbers, and tomatoes, the inflexion points are at 417,000, 329,000, and 489,000 pounds, respectively—compared to average monthly supplies of 119,000, 213,000, and 481,000 pounds during 1947–61.

The tangent at the inflexion point must be negative if the preceding portion of the total returns curve is to have a meaningful maximum. The inflexional tangent is negative for snap beans and positive for tomatoes at all levels of demand encountered during 1947–61. For cucumbers it is negative at very low demand levels and positive otherwise.

[24]For example, 2 of the 15 monthly observations for 1947–51 (May–July) compared to 14 of those for 1957–61 (January–March) correspond to elastic portion of the net price-quantity functions.

D. IMPLICATIONS

The primary purpose of this section is to indicate the economic implications of the results and to consider the validity and limitations of the study. A few suggestions for further study are also presented. This is not the place to enter into the subtleties of these matters. Hence, only a general discussion is given of the major points involved.

1. Economic Implications of the Findings

An extensive restatement of the results does not appear warranted since the findings are discussed in considerable detail in the foregoing sections. Yet it may be well, before discussing their implications, to summarize the main conclusions. Average *ex post* relations, determined empirically for 1947–61, show that demand for vine vegetables at the Honolulu wholesale market has the following characteristics:

(1) The price of each vine vegetable is related to supply by a convex parabola of slight curvilinearity.
(2) Changes in supply "explain" much of the price variations.
(3) Demand shifts annually along a parabolic trend which reached its minimum about a decade ago.
(4) Demand is at its seasonal high in February or March, declines rapidly for about 3 months, and then increases.
(5) Demand elasticities change temporally because of annual and seasonal shifts in demand levels.
(6) Demand elasticities differ for the three vine vegetables. Over the range of supply generally marketed, demand is elastic during all months for tomatoes and becomes inelastic during some months for cucumbers and during many months for snap beans.[25]

The above relates to demand at the wholesale market. Demand at the farm level is assumed to be substantially below that at wholesale and approximately parallel to it.[26] If this situation exists, as seems likely, farm demand is considerably less elastic. Since the demand curve shifts its position considerably as the season advances, elasticity changes substantially at both farm and wholesale levels. During summer months, the entire supply, particularly if it is large, cannot be sold without decreasing net returns to growers below what could be secured from the sales of a smaller quantity. This result is likely to occur most often for snap beans, less frequently for cucumbers, and only occasionally, if at all, for tomatoes.

[25]This comparison is in terms of the reciprocals of price flexibilities for 1957–61 —see table 3. Although such values are mere rough approximations of elasticity, they suffice to indicate relative values.

[26]This assumption appears reasonable because of the nature of the farm-wholesale price spread. It consists of two parts which tend to vary in different ways. The selling commission is a percentage of the wholesale price. Other costs incurred in moving farm supplies to market remain approximately constant during a given season regardless of the quantity sold (within broad limits), although they change from year to year.

If the upward trend shift in demand indicated by the analysis continues into the future at even half the magnitude secured, points of unit elasticity on the demand curves (at wholesale and at the farm) will continue to move to the right at a fairly rapid rate. This means, of course, less and less likelihood of supplies being sufficiently large in the future to depress price to a level which reduces net returns for quantities marketed during summer months—even in the case of snap beans. Yet it may be several years before growers overcome their present fear of producing more generously for the Honolulu "pocket market."

The above comparison of relative demand elasticities over the season also suggests the possibility of shifting planting times so that some of the supply now harvested when demand shifts downward becomes available earlier in the season. Numerous factors must be considered when plans are laid for changing the acreage planted to specific crops on individual farms or by the entire vegetable industry.[27]

Trend shifts for these three vegetables (and presumably for other crops that can use the land) are at different rates. Thus, net farm returns per pound may increase at substantially different rates. When these changes are compared with future changes in production costs, relative profitability of the different vegetables will be altered. Production shifts on an annual basis are likely to occur.

2. Validity and Limitations of the Study

In this study, demand is conceived as the empirically determined price-quantity function confronting sellers of vine vegetables at the Honolulu wholesale market. Underlying these empirical analyses is a fundamental assumption (discussed in Section B-1), which may be rephrased in a condensed form: Supply (at the Honolulu wholesale market) is sufficiently routinized so that the unknown price-quantity relations remain relatively stable and may be approximated by simple empirical functions fitted to the observed data for the period studied. Hence, the basic problem becomes one of considering the type of relations postulated, the variables retained in the equations, the adequacy of the data, and the agreement of results with *a priori* expectations.

Simple functions are used. Possibly, these are too simple to describe the underlying relations adequately. They may, however, provide convenient first approximations over the range of observations used in the study. Furthermore, when more complex relations are fitted, considerable ambiguity exists as to which specific alternate equations should be used. The results derived may give good forecasting equations even though they do describe the true relations less satisfactorily. Since supply of each of

[27]Consideration must be given to relative yields and relative production and harvest costs during different months, to comparative trends in acreage and production and to many cultural and environmental factors. These aspects of the problem are not considered here since this discussion is intended to be suggestive rather than inclusive.

the three vine vegetables has a slight downward trend over recent years, monthly supply data for the near future should be within the range established by the past. Thus, forecasts for the years immediately ahead do not require extrapolations beyond the range of observations used for deriving the regressions secured.

The equations provide for parallel movements in the demand curves as shift variables assume different values. Obviously, the formulation could and possibly should be generalized to permit changes in slopes also—by adding specific product terms to the equations. This step was not taken only because it was assumed that such systematic rotations in the net regressions were less likely, over the range of observations, than parallel shifts.

It is recognized that price is determined by the combined influence of numerous factors. Section B-3 gives the reasons for including only three independent variables (quantity, month, and year) in the final equations. This use of so few variables is a limitation of the study attempted. To the extent that any of the omitted factors exert important influences, the estimates of the regression coefficients may be biased.

The data are not entirely satisfactory. In the first place, both the price and supply series are subject to measurement errors. Consequently, the estimates (of regression and correlation coefficients) do not possess the optimum properties specified by statistical theory and may be biased. Secondly, some desired information is not available on the basis wanted. For example, weekly data may be necessary for adequately testing whether successive time markets are interdependent in the sense that sales in one period affect the level (or slope) of demand later during the season.

The hypothesis tested is a simple one. Yet the results derived agree completely with expectations—see Section C. Furthermore, the findings give considerable information about price determination on the Honolulu wholesale market. They are of importance to the vegetable industry, produce handlers, and economists. Possibly of greatest significance is the magnitude of the temporal shifts in demand. Also, there is a strong indication that these annual and seasonal changes follow approximately similar patterns for the three vegetables studied.

Corresponding demand schedules at the farm and retail levels can be approximated from the relations prevailing at the wholesale market. These give the bases for making various estimates of economic relations. For example, it becomes possible to determine maximum quantities to be marketed by farmers (as a group) in order to avoid a decline in total returns associated with increased sales alone, with other factors held constant.

Of particular concern to farmers and others is the extent to which the relations remain stable. The monthly and annual demand shifts derived relate to average composite influences exerted by numerous factors. Actually, the effect of some of the omitted variables may have changed abruptly during 1947–61 or may change suddenly in the near future. The analyses shed no light on this problem. They do indicate, however, that roughly

similar results are obtainable if the functions are fitted separately to subperiods of 5 years. This evidence suggests that temporal patterns probably changed randomly rather than systematically during 1947–61. There is no basis for expecting this situation to be altered significantly in the next few years—nor, for that matter, for it to remain unchanged.

The remaining paragraphs of this section are devoted to discussing briefly the suitability of using methods of classical regression analysis to determine the average *ex post* relations for a demand study. All of the conditions for a valid application of this technique are not met by the data. However, this procedure is no more restrictive in terms of assumptions imposed than are alternate methods available for approximating relations among economic variables.

Severe criticism is sometimes levied at attempts to derive demand functions statistically. Three major objections are raised:

(1) Time series data represent a unique sequence of observations which preclude a possibility of analysis.

(2) Classical regression techniques do not provide an adequate method for estimating structure parameters.

(3) Derived results describe historical relations and not theoretical demand functions.

Admittedly, these objections pose serious obstacles to an endeavor at empiricizing relations used by economists. The author's view is that the difficulties are not insurmountable and that the "givens" used by economic theorists to explain changes in prices and sales actually are unknowns which must be determined empirically. As already stated, the approach used rests on the assumptions that:

(1) Times series data constitute a set of drawings selected at random from imaginary infinite populations and the impossibility of repeated drawings is not construed as a serious difficulty.

(2) Ordinary least-squares methods can be used to derive suitable relations among variables.

(3) Derived results, although not necessarily descriptive of the theorist's concept of demand, can provide useful information about price behavior and can specify a rational basis for making predictions.

3. Suggestions for Further Study

Although several aspects of demand were investigated, the foregoing discussion contains some gaps stemming from the fact that all relations having a significant bearing on the conclusions were not—in fact, could not—be studied. A few specific suggestions for additional studies can be indicated.

The study of factors affecting vine vegetable prices could be extended in several ways. Three are mentioned here. Certainly, changes in a commodity's quality can be expected to cause price variations. Hence, it

seems desirable to make an attempt to obtain a reliable measure of quality. Possibly this could be done by collecting information about quality for a few seasons. Secondly, a comprehensive treatment of complementarity relations is needed. This may have to be delayed until the theoretical basis for selecting such competing products is more fully developed. Supplies of competing vegetables were introduced more or less arbitrarily on a trial-and-error basis. The results secured are not satisfactory. Finally, the interdependence among temporal markets requires another examination. The attempt made here gave unsatisfactory results—possibly largely because a month is too long a period for this purpose. Weekly data might be collected for a few years to determine whether prices are affected by both current supply and the supply available a short while previously.

The analyses refer to average relations (of specified and relatively simple types) existing during 1947–61. The results seem to indicate that the relations have not changed drastically over time. This phase of the study, however, was not investigated thoroughly. Some detailed attempts should be made in order to evaluate the adequacy of the model used in explaining the complicated mechanism for determining prices. Thus, a more satisfactory evaluation of the economic problems facing these industries requires that additional attention be given to specifying more suitable models, to collecting better data, and to developing improved techniques of analysis.[28]

Measurements of supply response are not a part of this demand study. However, a satisfactory determination of long-run movements in prices requires examination of forces affecting variations in acreage and yield—the two determinants of production—and of those causing changes in imports of supplies from out-of-state sources.

The results show that demand curves for vine vegetables shift their level substantially during each season—by approximately 7 cents per pound for each of the three vegetables. Furthermore, because of changes in market supply, sales occur at a point farther to the right on the demand curve when the curve is shifted downward than when it is at its seasonal high level. As a result, expected prices vary during the season by more than 50 percent of the average for 1947–61. The difference is still greater at the farm level since farm-wholesaler marketing margins remain relatively constant during a particular season.

This situation immediately suggests the possibility of individual farmers changing their production patterns to grow more during months when the demand curve is high. By doing so, however, they will encounter additional production problems. There is very little information now available to indicate how production costs of these vegetables (or other commodities, for that matter) vary over the season. Such production cost studies as well as additional demand analyses are needed to provide farmers with a better basis for making their decisions.

[28]Of course, this is the situation encountered in practically all statistical investigations.

METHODOLOGY APPENDIX

Note 1. (*Section B-2*). The demand function may for various reasons vary systematically over the course of a season. This variation may mean that for each subperiod the demand curve is at a different level, has a different slope, or assumes a different form (e.g., degree of curvilinearity). Such intraseasonal shifts may be introduced into the formulation in several ways.

The following exposition assumes that monthly prices (P) are to be related to monthly quantity (Q), monthly index of consumer purchasing power (I), and month of the season (M). For convenience, the explanation is confined to arithmetic equations including only four variables with monthly data. Of course, other subperiods (e.g., weeks or quarters) might be used. The equations can be generalized by adding other shift variables and by introducing curvilinearity and joint effects.

It might, for example, be assumed that changes in the demand function should be left free to vary from month to month. This procedure treats the data for each month over a period of years as a separate set of observations. Thus the equation fitted to the data for each month is of the form:

$$P = a + bQ + cI.$$

Differences among the 12 equations are limited to changes in level and slope. The results are then examined to determine the extent that uniformity in the shifts might be indicated. Presumably, differences would be accepted as significant if a comparison of the equations displays an "orderly fan-shaped arrangement." The lack of some such systematic changes is likely to be accepted as evidence indicating that the differences are not significant.[29]

A second approach, the one followed in this study (see Section B-2 above), combines all the monthly data as a single set of observations and results in one regression equation with an additional term:

$$P = a + bQ + cI + dM.$$

This procedure introduces into the equation a new variable (M) which permits shifts to be systematized by determining the average parallel shift occurring from month to month.

In this form the second technique has obvious shortcomings relative to the first. It provides for uniform parallel shifts such that the level for the

[29]This is the substance of the procedure used by G. L. Mehren and H. E. Erdman in their study of weekly prices of Louisiana strawberries. See "An Approach to the Determination of Intraseasonal Shifting of Demand," *Journal of Farm Economics*, May 1946, pp. 587–96. A similar approach is used by S. Hoos and R. W. Seltzer, "Lemons and Lemon Products: Changing Economic Relationships, 1951–1952," California Agr. Exp. Sta. Bull. 729 (1952), and S. Hoos and J. N. Boles, "Oranges and Orange Products: Changing Economic Relationships," California Agr. Exp. Sta. Bull. 731 (1953).

last month may be substantially above or below the first month's level. It does not allow for changes in the slope of the demand function. These disadvantages can be corrected by introducing additional terms. Non-uniform shifts in level (to any degree desired) can be secured by using a power series in M. Shifts in slope can be secured by adding various product terms. For example, parabolic changes in both level and slope are incorporated into the equation by changing it to the following form:

$$P = a + (b + b'M)Q + (c + c'M)I + (d + d'M)M.$$

By using second and higher degree terms of M in the brackets of this equation, the rates at which the regression coefficients change over the season may be increased or decreased gradually or altered in some other fashion.[30]

Note 2. (Section C-5). The notion of elasticity is used in economic theory to express the ratio in proportionate changes of two related variables. Specifically, elasticity of demand with respect to price is the proportionate change in demand relative to the associated proportionate change in price. This coefficient measures the responsiveness of the quantity taken to price changes and is computed (for some point on the demand function, say P_1, Q_1) from the formula:

$$\eta = \frac{\text{relative change in Q}}{\text{relative change in P}} = \frac{\text{change in Q} \div Q_1}{\text{change in P} \div P_1} = \frac{P_1\, dQ_1}{Q_1\, dP_1}, \text{ where } \frac{dQ_1}{dP_1}$$

is the slope of the demand curve at the point P_1, Q_1.

To measure how responsive prices are to changes in sales (or quantity), the proportionate changes are compared in reverse order. This ratio, called the coefficient of price flexibility, is computed for point P_2, Q_2 by

$$\lambda = \frac{\text{relative change in P}}{\text{relative change in Q}} = \frac{Q_2\, dP_2}{P_2\, dQ_2}.$$

Since price and quantity are negatively related the two derivatives are negative and all values determined from the above formulas are minus values. For this reason it is sometimes convenient to introduce a minus sign into the definitions and secure positive values for the coefficients. This is the procedure followed here. Hence, the formulas become

$$(1)\ \eta = -\frac{P_i\, dQ_i}{Q_i\, dP_i} \text{ and } \lambda = -\frac{Q_i\, dQ_i}{P_i\, dP_i}.$$

[30]This is the procedure used by J. Foytik, "Characteristics of Demand for California Plums," *Hilgardia*, April 1951, pp. 407–527, and by S. H. Sosnick, "Orderly Marketing for California Avocados," *Hilgardia*, December 1962, pp. 707–776.

It appears as though the two values given by (1) are reciprocals. This is the case only if both are computed from the same price-quantity relation because then the derivatives are reciprocals of each other when computed for a given point on the curve. When, however, the net price-quantity relations are determined statistically (as, for example, by correlation techniques) two equations are obtained according to whether price or quantity is taken as the dependent variable. Then the derivatives are not reciprocals of each other and, consequently, λ computed from one equation is not the exact reciprocal of η computed from the other. When there is a high correlation between price and quantity the derivative of $Q = f(P)$ is almost equal to the reciprocal of the derivative of $P = f(Q)$ so that the reciprocal of λ is a good approximation for η.

The point can be illustrated by considering the simple case of linear functions derived statistically: $Q = A - BP$ and $P = a - bQ$, for which the derivatives are $-B$ and $-b$. The price associated with quantity Q_1 is $P_1 = (A - Q_1) \div B$ for the first equation and $P_2 = a - bQ_1$ for the second. (The two prices are equal only if Q_1 corresponds to the intersection of the equations.) Substituting into (1) gives

$$(2)\ \eta = \frac{BP_1}{Q_1} = \frac{A - Q_1}{Q_1} = \frac{A}{Q_1} - 1 \text{ and } \frac{1}{\lambda} = \frac{P_2}{bQ_1} = \frac{a - bQ_1}{bQ_1} = \frac{a}{bQ_1} - 1.$$

These values are equal if and only if perfect correlation exists between price and quantity.[31] The values defined by (2) are zero at the quantity intercepts for $Q = A - BP$ and $P = a - bQ$, whether the correlation is perfect or less. The values are positive for any smaller (positive) quantity.

Demand elasticity and price flexibility have the same values for different points on the net price-quantity equation only in special cases. Generally, for increasing quantity the demand function gets less elastic while its price flexibility increases. Hence, for most statistically derived functions, any number of values can be computed for either coefficient. A common practice is to calculate values at the centroid, i.e., at the means of the different variables.

Even this procedure, however, leaves some doubt because if curvilinear relations are established, the means of the independent and dependent

[31]The Q – intercepts for $Q = A - BP$ and $P = a - bQ$ are $Q = A$ and $Q = \frac{a}{b}$, respectively. If correlation is perfect, the two equations represent one line and their Q – intercepts are equal–i.e., $A = \frac{a}{b}$. Hence, $\eta = \frac{1}{\lambda}$ If, on the other hand, $\eta = 1/\lambda$, then, from (2), $A = \frac{a}{b}$ –i.e., the Q – intercepts are equal. But the two equations, when determined by the method of least squares, also pass through the point represented by the mean values of P and Q. Hence, they define the same line and correlation is perfect.

variables do not lie on the curve. The exact method followed here in computing price flexibility at the centroid is to use the formula

$$\lambda = -\frac{\bar{Q}}{\bar{P}}\frac{\partial P}{\partial Q},$$ where $\bar{Q}$ is the mean quantity, and $\bar{P}$ and the derivative

are values at this point on the regression equation. A partial derivative is indicated since price is related to quantity and other independent variables. Values for λ are obtained for different time periods by using the appropriate average quantity and corresponding regression equation. Price flexibility for 1947–51, 1952–56, and 1957–61 is determined by starting with the average quantity for the 60 monthly observations for each subperiod and shifting the regression equation by the average trend change for the 5 years considered. Quarterly values for a subperiod are computed similarly from the average quantity for the 15 monthly observations for that quarter—e.g., January–March, 1957–61.

STATISTICAL APPENDIX

Certain data collected in the course of preparing this report are presented here for the convenience of readers. This compilation is in two parts: (A) "Basic Data" used in making the monthly price analyses, and (B) "Auxiliary Information" gathered for other parts of the report.

Part A includes:

Tables A-1 to A-4: Honolulu wholesale prices, monthly, 1947–62.

Tables A-5 to A-9: Honolulu wholesale supply, monthly, 1947–62.

Part B includes:

Tables B-1 and B-2: Statistical measures for frequency series.

Tables B-3 to B-6 and figure B-1: Supplemental data on Honolulu deliveries and unloads.

Table B-7: Data on economic activity in Hawaii.

Tables B-8 to B-10: Price residuals for regression analysis.

Data for tables A-1 to A-9 and B-3 to B-6 are compiled from or based upon information assembled and published by the Hawaii Crop and Livestock Reporting Service and the Hawaii Federal-State Market News Service. Reports issued by these two governmental agencies may be consulted to obtain (for these and other commodities) additional information, revisions, and current data. All the data used herein come from their annual reports, entitled for 1961, respectively: *Statistics of Hawaiian Agriculture, 1961* and *1961 Honolulu Unloads: Fruits, Vegetables, Meats, Dairy and Poultry Products.* Somewhat different titles were used in some earlier years. During 1947–51 these data were released annually in a single publication instead of in two reports as is done now.

This evolution in the method of publishing the data and change in titles should not be confusing. Hence, for the sake of simplicity, all references (in this appendix and in the body of the report) to those reports is by means

of *Statistics of Hawaiian Agriculture* and *Honolulu Unloads.* In some cases, 1962 data were obtained from the agencies, prior to publication. These are listed here as coming from the 1962 reports. Of course, such data should be considered as preliminary.

Certain adjustments are included. Derived figures (particularly averages and percentages) are computed from unrounded data and may, of course, vary somewhat from the results indicated by the rounded data shown. When percentage distributions (of monthly supplies, of deliveries by source, etc.) are determined, their sums may not total 100.0 percent exactly because of rounding. Similarly, 5-year averages of monthly supplies rounded to the nearest 1,000 pounds do not exactly equal the average (rounded) of the five annual totals. In these and other such cases data for the components are modified slightly to give "accurate" totals. (Another researcher might make different "corrections.")

The general practice is followed of using "0" for a quantity to designate either no quantity (zero) or an amount less than 5 in the next significant place. For example, a "0" means any quantity less than 5 (including zero) where data are shown to the nearest 10 units, less than 0.5 where data are in units, less than 0.05 where data are given to one decimal places, etc.

There are a few slight discrepancies in data tabulated in different tables. These arise primarily for two reasons. In some cases data were rounded differently. Some reports give revisions in totals without indicating how monthly data (or other components) were changed. In such cases the unrevised data are shown as sums of the components while revised totals are given in other tables. (It did not appear necessary to iron out all of these minor differences for our purposes.)

TABLE A-1

Beans, Snap: Honolulu Wholesale Price for No. 1 Grade (cents per pound),[a/] by months, 1947-62

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
1947	19.9	21.4	24.5	13.3	6.8	15.2	20.3	13.7	14.7	17.0	19.8	19.4	17.2
1948	23.1	26.5	25.4	8.8	12.9	13.7	16.7	9.5	13.6	18.5	24.3	22.3	17.9
1949	17.1	33.0	19.9	7.3	8.1	15.2	17.4	12.8	15.5	19.0	21.5	10.2	16.4
1950	15.4	20.5	19.3	18.5	12.5	10.2	14.5	13.8	13.7	12.4	17.0	27.6	16.3
1951	22.0	21.1	29.0	34.8	14.2	9.6	18.4	19.8	9.8	16.3	23.0	22.5	20.0
1952	19.3	19.5	16.9	14.6	12.9	13.6	21.7	17.2	18.8	17.8	24.5	20.8	18.1
1953	13.2	18.7	22.7	11.2	10.7	15.6	16.3	14.6	18.5	13.4	19.9	9.9	15.4
1954	16.5	17.5	27.8	15.0	16.2	8.9	13.7	16.9	22.5	15.1	10.5	24.2	17.1
1955	29.0	28.0	26.5	13.7	8.1	10.6	8.8	13.6	10.4	10.5	15.6	27.8	16.9
1956	32.7	33.0	24.9	9.4	13.7	18.7	21.1	15.0	15.3	15.6	18.3	27.5	20.4
1957	19.2	28.2	24.0	13.4	14.9	11.9	21.5	21.7	22.4	21.8	22.1	28.4	20.8
1958	30.4	19.0	21.8	20.0	8.3	7.1	17.6	22.1	28.8	28.2	23.8	17.0	20.3
1959	17.6	32.0	22.0	11.1	12.8	17.5	27.8	32.2	22.0	17.8	24.5	34.7	22.7
1960	35.5	19.0	24.8	21.2	26.0	29.0	27.1	24.8	28.2	27.1	28.9	29.1	26.7
1961	31.9	32.0	32.2	17.9	11.4	15.6	19.7	20.9	27.9	20.9	28.7	31.8	24.2
1962	26.9	33.5	30.0	19.9	15.9	12.6	21.0	24.7	18.8	13.5	18.4	22.7	21.5
Average													
1947-51	19.5	24.5	23.6	16.5	10.9	12.8	17.5	13.9	13.5	16.6	21.1	20.4	17.57
1952-56	22.1	23.3	23.8	12.8	12.3	13.5	16.3	15.5	17.1	14.5	17.8	22.0	17.58
1957-61	26.9	26.0	25.0	16.7	14.7	16.2	22.7	24.3	25.9	23.2	25.6	28.2	22.95
Percent of season average													
1947-51	111.0	139.4	134.5	94.1	62.1	72.7	99.4	79.2	76.6	94.7	120.2	116.1	
1952-56	125.9	132.8	135.1	72.7	70.1	76.7	92.8	87.9	97.3	82.4	101.0	125.3	
1957-61	117.3	113.4	108.7	72.8	64.0	70.7	99.1	106.0	112.7	100.9	111.5	122.9	
1947-61	118.1	128.5	126.1	79.9	65.4	73.4	97.1	91.0	95.5	92.7	110.9	121.4	

For footnotes and source see page following Table A-9.

TABLE A-2

Cucumbers: Honolulu Wholesale Price for No. 1 Grade (cents per pound),[a/] by months, 1947-62

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
1947	26.1	24.8	32.3	19.9	10.2	13.6	13.2	14.2	14.9	16.9	19.6	18.4	18.7
1948	24.7	26.6	19.2	8.6	12.5	9.4	15.4	13.5	10.9	11.4	12.7	14.0	14.9
1949	21.4	28.8	27.8	11.2	4.7	12.1	10.5	7.1	13.1	15.2	10.7	11.9	14.5
1950	17.5	18.8	16.2	9.4	11.7	12.0	13.5	14.8	14.5	9.3	8.2	18.3	13.7
1951	23.5	17.5	18.7	18.8	18.3	10.0	5.7	9.8	11.5	15.3	21.1	21.5	16.0
1952	19.3	15.7	11.1	15.7	7.9	11.9	14.5	16.5	7.9	10.3	10.5	8.8	12.5
1953	11.6	14.0	18.9	10.8	10.6	15.8	11.0	9.4	9.0	13.3	14.1	12.1	12.6
1954	13.6	16.2	22.2	8.9	6.4	9.4	10.6	12.6	15.4	15.2	9.6	20.4	13.4
1955	19.9	23.7	22.9	9.9	5.9	5.5	6.4	8.1	9.9	12.0	12.0	16.5	12.7
1956	17.1	22.5	11.8	9.0	12.2	10.7	15.0	13.4	12.5	10.4	11.4	10.8	13.1
1957	25.9	18.3	11.7	9.2	14.4	12.0	14.0	13.7	9.6	11.7	17.4	22.7	15.1
1958	24.4	19.2	22.5	12.2	5.4	6.5	13.9	22.6	16.7	15.5	18.1	10.0	15.6
1959	13.8	19.0	10.7	6.5	5.3	9.8	17.3	16.0	18.4	11.0	18.1	19.6	13.8
1960	24.7	24.4	26.3	17.4	8.9	8.7	10.3	10.8	16.1	15.9	19.7	15.4	16.6
1961	13.9	19.9	20.9	13.5	14.7	14.3	11.7	10.5	14.7	12.3	24.6	17.6	15.7
1962	25.0	29.0	14.5	14.6	10.0	10.5	14.6	11.3	9.6	11.3	13.1	12.5	14.7
Average													
1947-51	22.6	23.3	22.8	13.6	11.5	11.4	11.7	11.9	13.0	13.6	14.5	16.8	15.56
1952-56	16.3	18.4	17.4	10.9	8.6	10.7	11.5	12.0	10.9	12.2	11.5	13.7	12.84
1957-61	20.5	20.2	18.4	11.8	9.7	10.3	13.4	14.7	15.1	13.3	19.6	17.1	15.34
Percent of season average													
1947-51	145.5	149.8	146.8	87.3	73.8	73.4	75.0	76.4	83.4	87.5	93.0	108.1	
1952-56	126.9	143.4	135.3	84.5	67.0	83.0	89.5	93.4	85.2	95.3	89.7	106.8	
1957-61	133.9	131.4	120.1	76.7	63.5	66.9	87.6	96.0	98.4	86.6	127.7	111.2	
1947-51	135.5	141.5	134.1	82.8	68.1	74.4	84.0	88.6	89.0	89.8	103.5	108.7	

For footnotes and source see page following Table A-9.

TABLE A-3

Tomatoes, Loose: Honolulu Wholesale Price for No. 1 Grade (cents per pound),[a/] by months, 1947-62

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
1947	21.0	18.8	24.6	24.9	19.6	14.5	14.3	13.4	11.2	13.4	15.4	23.7	17.9
1948	25.8	25.8	27.0	22.0	17.1	12.8	15.3	14.1	16.5	20.4	13.2	14.1	18.7
1949	17.5	20.6	22.8	16.4	9.3	8.0	15.3	18.8	17.0	13.5	12.9	15.5	15.6
1950	20.0	18.0	19.5	15.1	16.2	16.5	15.8	14.6	14.0	13.2	11.5	20.0	16.2
1951	23.3	22.9	25.5	26.6	23.7	9.6	9.3	12.3	12.6	13.9	16.0	21.5	18.1
1952	22.9	21.4	19.5	16.2	15.6	11.9	18.8	15.1	11.1	12.9	13.5	20.4	16.6
1953	20.7	18.3	15.2	15.7	10.5	13.7	15.2	15.1	10.5	13.2	9.8	14.0	14.3
1954	16.1	16.7	21.5	18.3	18.7	9.9	12.9	12.8	12.6	12.9	13.7	21.5	15.6
1955	20.2	21.7	22.4	21.7	15.2	8.5	8.2	9.2	10.5	13.3	12.0	16.0	14.9
1956	22.7	26.5	29.2	21.8	15.8	10.6	14.9	12.5	16.1	13.2	14.6	24.4	18.5
1957	19.5	12.5	16.8	20.4	18.9	21.5	15.2	15.5	16.1	17.2	17.6	22.5	17.8
1958	25.9	25.1	17.9	19.6	15.1	15.4	13.2	14.9	14.0	16.9	16.4	14.3	17.4
1959	15.7	20.8	19.2	19.3	14.9	17.7	13.8	15.8	18.0	17.4	21.4	25.2	18.3
1960	25.3	26.0	24.2	23.7	20.6	18.8	15.3	15.2	14.5	16.0	20.9	21.4	20.2
1961	16.4	15.9	21.7	23.0	16.7	21.4	23.6	18.5	18.6	22.0	21.5	21.4	20.1
1962	24.3	23.9	18.7	13.6	16.5	22.7	16.7	12.5	14.3	12.8	14.5	13.3	17.0
Average													
1947-51	21.5	21.2	23.9	21.0	17.2	12.3	14.0	14.6	14.3	14.9	13.8	19.0	17.30
1952-56	20.5	20.9	21.6	18.7	15.2	10.9	14.0	12.9	12.2	13.1	12.7	19.3	16.00
1957-61	20.6	20.1	20.0	21.2	17.2	19.0	16.2	16.0	16.2	17.9	19.6	21.0	18.74
Percent of season average													
1947-51	124.4	122.6	138.0	121.4	99.3	71.0	80.9	84.6	82.4	86.0	79.8	109.6	
1952-56	128.2	130.8	134.7	117.1	94.8	68.2	87.5	80.9	76.0	81.9	79.5	120.4	
1957-61	109.7	107.1	106.5	113.2	92.0	101.2	86.5	85.3	86.7	95.5	104.4	111.9	
1947-61	120.8	120.2	126.4	117.2	95.4	80.1	85.0	83.6	81.7	87.8	87.9	113.9	

For footnotes and source see page following Table A-9.

TABLE A-4

Tomatoes, Loose: Honolulu Wholesale Price for No. 2 Grade (cents per pound),[a/] by months, 1947-62

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
1947	17.8	14.6	20.5	20.3	15.4	11.0	11.1	10.6	8.8	11.6	12.9	19.4	14.5
1948	21.8	21.7	22.8	17.6	13.2	9.8	11.9	11.8	12.4	17.4	9.8	10.8	15.1
1949	13.9	15.8	17.7	12.0	6.5	6.2	12.0	15.8	14.0	10.0	10.0	12.5	12.2
1950	16.0	14.0	15.8	11.9	13.6	13.6	12.9	11.5	11.5	11.6	8.7	17.3	13.2
1951	19.4	19.0	21.9	22.9	19.3	-	-	11.0	9.8	11.5	12.4	18.5	16.6
1952	18.5	18.5	16.5	13.4	12.2	8.9	15.2	12.4	8.3	9.1	10.1	17.6	13.3
1953	15.9	12.2	11.7	12.5	7.5	9.7	12.5	11.7	7.6	10.8	6.9	10.7	10.8
1954	11.0	12.9	16.4	14.7	13.4	6.2	9.0	9.3	10.2	10.5	11.2	17.1	11.8
1955	15.9	16.5	17.8	16.7	10.9	5.6	5.6	5.7	7.4	10.6	8.2	12.8	11.1
1956	18.2	18.2	23.9	18.8	12.5	8.0	12.0	10.2	12.5	14.6	11.7	20.5	15.1
1957	16.1	9.1	14.0	17.0	15.9	18.0	11.8	12.0	13.5	14.8	14.1	19.7	14.7
1958	21.4	23.0	13.8	16.3	12.4	13.3	10.4	12.4	11.5	14.8	12.8	9.6	14.3
1959	11.7	17.0	15.3	15.8	11.0	14.2	10.5	12.5	13.8	14.1	17.2	21.3	14.5
1960	21.3	22.0	20.5	17.1	16.3	13.6	12.1	12.3	12.2	14.0	18.5	17.7	16.5
1961	13.2	12.8	18.4	17.5	11.6	17.8	19.4	14.9	13.5	18.7	19.0	18.2	16.2
1962	20.2	19.1	14.6	10.4	13.0	17.7	13.3	9.7	11.3	10.0	11.7	8.8	13.3
Average													
1947-51	17.8	17.0	19.7	16.9	13.6	10.2	12.0	12.1	11.3	12.4	10.8	15.7	14.23
1952-56	15.9	15.7	17.3	15.2	11.3	7.7	10.9	9.9	9.2	11.1	9.6	15.7	12.45
1957-61	16.7	16.8	16.4	16.7	13.4	15.4	12.8	12.8	12.9	15.3	16.3	17.3	15.24
Percent of season average													
1947-51	129.2	123.7	143.5	123.1	98.9	59.0	69.6	88.3	82.1	90.3	78.2	114.1	
1952-56	127.7	125.8	138.6	122.2	90.7	61.7	87.2	79.2	73.9	89.3	77.3	126.4	
1957-61	109.8	110.1	107.6	109.8	88.2	100.9	84.2	84.1	84.6	100.2	107.0	113.5	
1947-61	122.2	119.9	129.9	118.4	92.6	73.9	80.3	83.8	80.2	93.3	87.5	118.0	

For footnotes and source see page following Table A-9.

TABLE A-5

Beans, Snap: Honolulu Wholesale Supply (1,000 pounds),[b/] by months, 1947-62

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1947	70	79	56	242	182	109	112	136	128	149	79	108	1,450
1948	99	70	156	168	116	114	145	163	140	128	105	126	1,530
1949	92	47	90	155	148	88	88	134	106	101	86	123	1,258
1950	119	94	99	101	135	116	111	113	141	119	70	43	1,261
1951	75	86	45	65	124	156	117	113	108	123	81	95	1,188
1952	135	127	150	158	163	153	118	124	124	135	102	122	1,611
1953	159	176	108	169	146	127	133	130	131	136	132	145	1,692
1954	116	106	77	125	125	146	131	113	121	143	149	61	1,413
1955	77	102	94	144	194	175	167	161	161	175	100	104	1,654
1956	50	51	136	170	137	106	132	143	158	131	136	79	1,429
1957	116	55	121	156	166	130	126	133	124	143	121	30	1,421
1958	111	140	109	138	165	142	114	78	95	120	104	131	1,447
1959	109	73	159	167	157	111	86	91	153	139	94	73	1,412
1960	91	135	118	101	93	86	120	119	111	107	113	103	1,297
1961	119	96	113	139	183	125	122	97	105	121	91	104	1,415
1962	99	86	103	153	131	166	113	123	127	125	125	95	1,446
Average													
1947-51	91.0	75.2	89.2	146.2	141.0	116.6	114.6	131.8	124.6	124.0	84.2	99.0	1,337.4
1952-56	107.4	112.4	113.0	153.2	153.0	141.4	136.2	134.2	139.0	144.0	123.8	102.2	1,559.8
1957-61	109.2	99.8	124.0	140.2	152.8	118.8	113.6	103.6	117.6	126.0	104.6	88.2	1,398.4
Percent of season total													
1947-51	6.8	5.6	6.7	10.9	10.5	8.7	8.6	9.9	9.3	9.3	6.3	7.4	
1952-56	6.9	7.2	7.3	9.8	9.8	9.1	8.7	8.6	8.9	9.2	7.9	6.6	
1957-61	7.8	7.1	8.9	10.0	11.0	8.5	8.1	7.4	8.4	9.0	7.5	6.3	
1947-61	7.2	6.7	7.6	10.2	10.4	8.8	8.5	8.6	8.9	9.2	7.2	6.7	

For footnotes and source see page following Table A-9.

TABLE A-6

Cucumbers: Honolulu Wholesale Supply (1,000 pounds),[b/] by months, 1947-62

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1947	123	63	75	220	209	180	179	240	160	273	80	205	2,007
1948	107	97	197	193	202	172	254	214	326	208	220	176	2,366
1949	74	98	106	167	254	185	260	276	204	192	205	184	2,205
1950	151	186	253	150	181	215	191	167	192	202	170	96	2,154
1951	179	173	156	123	184	288	198	196	231	178	133	189	2,228
1952	196	254	209	246	248	266	157	255	240	264	237	299	2,871
1953	215	147	199	277	179	190	230	259	161	180	200	186	2,423
1954	218	144	131	277	302	246	240	186	163	250	248	157	2,562
1955	168	148	200	309	341	310	266	240	207	290	208	241	2,928
1956	168	193	310	289	249	236	218	248	289	268	261	156	2,885
1957	185	192	277	317	250	208	209	298	288	234	195	164	2,817
1958	190	195	133	285	333	260	189	148	290	232	196	287	2,738
1959	181	230	249	288	300	277	186	182	203	224	200	171	2,691
1960	143	170	125	296	294	266	251	256	178	178	227	203	2,587
1961	285	137	283	198	277	220	279	273	264	239	197	200	2,852
1962	171	194	245	223	367	269	223	262	287	291	246	238	3,016
Average													
1947-51	126.8	123.4	157.4	170.6	206.0	208.0	216.4	218.6	222.6	210.6	161.6	170.0	2,192.0
1952-56	193.0	177.2	209.8	279.6	263.8	249.6	222.2	237.6	212.0	250.4	230.8	207.8	2,733.8
1957-61	196.8	184.8	213.4	276.8	290.8	246.2	222.8	231.4	244.6	221.4	203.0	205.0	2,737.0
Percent of season total													
1947-51	5.8	5.6	7.2	7.8	9.4	9.5	9.8	10.0	10.2	9.6	7.4	7.7	
1952-56	7.1	6.5	7.7	10.2	9.6	9.1	8.1	8.7	7.8	9.2	8.4	7.6	
1957-61	7.2	6.8	7.8	10.1	10.6	9.0	8.1	8.5	8.9	8.1	7.4	7.5	
1947-61	6.7	6.3	7.5	9.4	9.9	9.2	8.7	9.0	9.0	9.0	7.7	7.6	

For footnotes and source see page following Table A-9.

TABLE A-7

Tomatoes: Honolulu Wholesale Supply (1,000 pounds),[b/] by months, 1947-62

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1947	537	385	462	316	716	334	578	654	480	673	368	480	5,983
1948	343	337	589	430	481	459	458	484	480	456	538	471	5,526
1949	430	325	447	479	560	384	370	450	507	442	380	384	5,158
1950	406	405	498	380	413	363	398	441	433	503	332	349	4,921
1951	321	386	330	380	545	451	485	286	433	518	462	334	4,931
1952	388	425	440	438	434	357	354	436	415	456	350	371	4,864
1953	391	444	439	439	421	386	495	484	464	471	450	387	5,271
1954	393	375	448	360	523	512	475	579	404	518	383	431	5,401
1955	401	458	435	486	614	605	572	608	510	587	536	484	6,296
1956	513	564	416	508	627	539	648	519	578	645	461	607	6,625
1957	538	646	416	528	499	402	634	451	619	478	591	454	6,256
1958	379	517	481	535	651	582	640	535	596	649	536	482	6,583
1959	557	441	612	520	467	668	558	588	593	619	507	427	6,557
1960	472	356	585	394	551	534	451	672	468	631	441	612	6,167
1961	527	451	492	535	517	435	619	603	523	497	489	435	6,123
1962	545	499	564	580	446	504	617	527	629	613	633	530	6,687
Average													
1947-51	407.4	367.6	465.2	397.0	543.0	398.2	457.8	463.0	466.6	518.4	416.0	403.6	5,303.8
1952-56	417.2	453.2	435.6	446.2	523.8	479.8	508.8	525.2	474.2	535.4	436.0	456.0	5,691.4
1957-61	494.6	482.2	517.2	502.4	537.0	524.2	580.4	569.8	559.8	574.8	512.8	482.0	6,337.2
Percent of season total													
1947-51	7.7	6.9	8.8	7.5	10.3	7.5	8.6	8.7	8.8	9.8	7.8	7.6	
1952-56	7.3	8.0	7.7	7.8	9.2	8.4	9.0	9.2	8.3	9.4	7.7	8.0	
1957-61	7.8	7.6	8.2	7.9	8.5	8.3	9.1	9.0	8.8	9.1	8.1	7.6	
1947-61	7.6	7.5	8.2	7.8	9.3	8.1	8.9	9.0	8.6	9.4	7.9	7.7	

For footnotes and source see page following Table A-9.

TABLE A-8

Tomatoes: Honolulu Wholesale Supply from Island Production (1,000 pounds),[b/] by months, 1947-62

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1947	218	180	256	212	336	305	256	298	279	258	247	225	3,070
1948	228	190	143	274	354	389	256	157	235	456	538	461	3,681
1949	389	282	209	428	556	384	370	390	507	442	363	359	4,679
1950	320	243	271	335	300	319	384	363	272	270	270	194	3,541
1951	203	212	139	93	315	445	449	208	189	220	166	228	2,867
1952	163	177	313	419	427	354	354	221	246	287	203	264	3,428
1953	324	390	414	411	417	384	393	297	368	310	367	376	4,451
1954	391	332	317	320	513	507	378	412	307	268	285	271	4,301
1955	359	390	400	453	597	605	563	551	440	337	455	470	5,620
1956	393	247	355	499	600	539	426	353	258	381	344	363	4,758
1957	413	558	371	496	445	357	400	261	228	301	452	287	4,569
1958	260	407	471	535	651	582	610	301	186	249	373	477	5,102
1959	540	257	305	461	466	491	452	304	175	244	218	337	4,250
1960	314	249	336	375	487	501	386	332	201	253	225	481	4,140
1961	518	429	361	461	460	363	357	388	299	305	273	344	4,558
1962	364	376	494	580	435	359	424	429	344	374	460	512	5,151
Average													
1947-51	271.6	221.4	203.6	268.4	372.2	368.4	343.0	283.2	296.4	329.2	316.8	293.4	3,567.6
1952-56	326.0	307.2	359.8	420.4	510.8	477.8	422.8	366.8	323.8	316.6	330.8	348.8	4,511.6
1957-61	409.0	380.0	368.8	465.6	501.8	458.8	441.0	317.2	217.8	270.4	308.2	385.2	4,523.8
Percent of season total													
1947-51	7.6	6.2	5.7	7.5	10.5	10.3	9.6	8.0	8.3	9.2	8.9	8.2	
1952-56	7.2	6.8	8.0	9.3	11.3	10.6	9.4	8.1	7.2	7.0	7.3	7.8	
1957-61	9.0	8.4	8.2	10.3	11.1	10.1	9.8	7.0	4.8	6.0	6.8	8.5	
1947-61	7.9	7.1	7.3	9.0	11.0	10.3	9.6	7.7	6.8	7.4	7.7	8.2	

For footnotes and source see page following Table A-9.

TABLE A-9

Tomatoes: Honolulu Wholesale Supply from Imports (1,000 pounds),[b/] by months, 1947-62

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1947	319	205	206	104	380	29	322	356	201	415	121	255	2,913
1948	115	147	446	156	127	70	202	327	245	0	0	10	1,845
1949	41	43	238	51	4	0	0	60	0	0	17	25	479
1950	86	162	227	45	113	44	14	78	161	233	62	155	1,380
1951	118	174	191	287	230	6	36	78	244	298	296	106	2,064
1952	225	248	127	19	7	3	0	215	169	169	147	107	1,436
1953	67	54	25	28	4	2	102	187	96	161	83	11	820
1954	2	43	131	40	10	5	97	167	97	250	98	160	1,100
1955	42	68	35	33	17	0	9	57	70	250	81	14	676
1956	120	317	61	9	27	0	222	166	320	264	117	244	1,867
1957	125	88	45	32	54	45	234	190	391	177	139	167	1,687
1958	119	110	10	0	0	0	30	234	410	400	163	5	1,481
1959	17	184	307	59	1	177	106	284	418	375	289	90	2,307
1960	158	107	249	19	64	33	65	340	267	378	216	131	2,027
1961	9	22	131	74	57	72	262	215	224	192	216	91	1,565
1962	181	123	70	0	11	145	193	98	285	239	173	18	1,536
Average													
1947-51	135.8	146.2	261.6	128.6	170.8	29.8	114.8	179.8	170.2	189.2	99.2	110.2	1,736.2
1952-56	91.2	146.0	75.8	25.8	13.0	2.0	86.0	158.4	150.4	218.8	105.2	107.2	1,179.8
1957-61	85.6	102.2	148.4	36.8	35.2	65.4	139.4	252.6	342.0	304.4	204.6	96.8	1,813.4
Percent of season total													
1947-51	7.8	8.4	15.1	7.4	9.8	1.7	6.6	10.4	9.8	10.9	5.7	6.4	
1952-56	7.7	12.4	6.4	2.2	1.1	.2	7.3	13.4	12.8	18.5	8.9	9.1	
1957-61	4.7	5.6	8.2	2.0	2.0	3.6	7.7	13.9	18.9	16.8	11.3	5.3	
1947-61	6.8	8.8	9.9	3.9	4.3	1.8	7.2	12.6	13.8	15.4	8.6	6.9	

For footnotes and source see following page.

FOOTNOTES AND SOURCES FOR TABLES A-1 to A-9

[a] Prices are for Island-produced vegetables of the designated grade. A blank indicates no price reported for that particular month. Season and 5-year averages are simple averages computed from the monthly prices. Each "percent of season average" is computed from the unrounded monthly averages for the period indicated. (Note: The Market News Service reports price quotations for each Tuesday and Thursday "for stock of generally good quality in trucklot or part trucklot quantities sold to retailers and restaurants by wholesalers or producers." A simple average of the mid-points of these ranges for the Tuesdays and Thursdays of a calendar month is reported as the price for that month.)

[b] Supplies include Oahu marketings and unloads from all other sources. In the case of tomatoes two additional tables are included: (1) supply from "Island Production" (Oahu marketings and unloads from Neighbor Islands) and (2) supply from "Imports" (unloads from the U.S. Mainland and foreign countries). Unloads from foreign countries during 1947–62 consisted of the following quantities (in 1,000 pounds) of tomatoes: 24 in 1948; 42 in 1949; 12 in 1952; and 18 in 1961. There were none for snap beans and cucumbers.

Each "percent of season total" is computed from the unrounded monthly averages for the period indicated. (Note: Season totals were revised slightly in a few years. The unrevised totals are shown here, however, unless monthly data were also revised.)

Source: Prices for tables A-1 to A-4 are from *Hawaiian Agriculture*, annual reports for 1947–62—table 15 in the 1961 report and comparable tables for other years. Supplies for tables A-5 to A-9 are from *Honolulu Unloads*, annual reports for 1947–62—primarily tables 2, 3, and 5 in the 1961 report and comparable tables for other years.

TABLE B-1

Vine Vegetables: Statistical Measures for Frequency Series,[a] 1947-61

Item and measure[b]		Monthly data				Annual data
		1947-51	1952-56	1957-61	1947-61	1947-61
Price--cents per pound						
Beans, snap	M	17.57	17.58	22.95	19.37	19.36
	SD	5.98	6.04	6.67	6.75	3.12
	V	34.03	34.38	29.07	34.79	16.13
Cucumbers	M	15.56	12.84	15.34	14.58	14.59
	SD	5.92	4.31	5.27	5.35	1.72
	V	38.05	33.56	34.36	36.72	11.80
Tomatoes, No. 1 grade	M	17.30	16.00	18.74	17.35	17.35
	SD	4.81	4.66	3.16	4.42	1.72
	V	27.82	29.13	16.87	25.49	9.89
Tomatoes, No. 2 grade	M	14.23	12.45	15.24	13.97	13.99
	SD	4.52	4.06	3.28	4.02	1.81
	V	31.79	32.62	21.54	28.76	12.94
Supply--1,000 pounds						
Beans, snap	M	111.45	129.98	116.53	119.32	1,431.9
	SD	35.31	29.90	27.90	32.24	139.6
	V	31.68	23.00	23.94	27.02	9.75
Cucumbers	M	182.67	227.82	228.08	212.86	2,554.3
	SD	54.82	49.77	51.68	56.33	231.9
	V	30.01	21.85	22.66	26.47	9.08
Tomatoes, Total	M	441.98	474.28	528.10	481.46	5,777.5
	SD	89.44	88.20	79.05	92.78	628.4
	V	20.24	18.60	14.97	19.27	10.88
Tomatoes, Local	M	297.30	375.97	376.98	350.08	4,201.0
	SD	102.77	100.64	112.11	111.71	733.0
	V	34.57	26.77	29.74	31.91	17.45
Tomatoes, Imports	M	160.76	103.49	159.07	140.76	1,576.5
	SD	114.71	88.27	118.50	111.13	196.6
	V	71.35	85.30	74.49	78.96	12.47

a/ For price and supply data in Tables A-1 to A-9. Unless otherwise indicated price is for No. 1 grade and supply is for total market supply.

b/ The symbols represent the following measures: M--mean; SD--standard deviation; V--coefficient of variation.
(Note: V is computed as 100 SD ÷ M, using unrounded data.)

Source: Computed from data in Tables A-1 to A-9.

TABLE B-2

Vine Vegetables: Estimated Price and Supply and Statistical Measures for 1947-61 with comparisons for other fruits and vegetables

Item	Estimated values[a] for					Statistical measures[b]					Bend point[c]	
	1948	1951	1957	1960	1963	M	SD	A	B	C	Value	Date
Price--cents per pound												
Tomatoes, No. 1	17.55	16.19	17.18	19.53	23.10	17.347	1.715	16.066	0.165	0.0686	15.97	Apr. 1953
Tomatoes, No. 2	14.30	13.04	13.78	15.77	18.85	13.993	1.811	12.869	0.123	0.0602	12.81	June 1953
Beans, snap, No. 1	17.36	16.90	20.28	24.13	29.42	19.360	3.123	17.867	0.564	0.0799	16.87	Dec. 1950
Cucumbers, No. 1	16.10	13.94	13.76	15.75	19.13	14.593	1.722	13.157	-0.029	0.0769	13.14	Sept.1954
Supply--1,000 pounds												
Tomatoes, Hawaii	3,431	4,037	4,599	4,554	4,293	4,201.0	733.04	4,426.2	93.61	-12.048	4,608*	May 1958
Tomatoes, Other	1,898	1,378	1,396	1,934	2,826	1,576.5	196.58	1,210.7	3.04	19.606	1,211	June 1954
Tomatoes, Total	5,332	5,414	5,992	6,489	7,123	5,777.5	628.35	5,634.1	96.41	7.672	5,331	Mar. 1948
Beans, snap	1,388	1,452	1,456	1,397	1,298	1,431.9	139.63	1,474.3	0.75	-2.266	1,474*	Aug. 1954
Cucumbers	2,146	2,457	2,764	2,759	2,649	2,554.3	294.57	2,663.2	51.11	-5.849	2,775*	Nov. 1958
Other vine vegetables	679	589	505	511	549	564.0	d/	530.8	-13.98	1.778	503	June 1958
Vine vegetables	9,545	9,912	10,717	11,156	11,619	10,328	864.9	10,302.4	134.29	1.335		
Root vegetables	13,965	13,911	14,222	14,587	15,092	14,141	698.4	13,996.4	51.86	7.763	13,910	Feb. 1951
Leafy vegetables	12,671	12,885	15,129	17,159	19,794	14,332	1,886.0	13,704.5	374.00	33.617	12,664	Dec. 1948
Other vegetables	4,644	4,777	5,463	6,015	6,706	5,194	693.0	5,050.0	114.25	7.748	4,629	Feb. 1947
Total vegetables	40,824	41,482	45,528	48,916	53,214	43,995	1,174.6	43,050.4	674.29	50.551	40,802	Nov. 1947
Citrus fruits	13,817	13,129	11,982	11,523	11,139	12,598	1,545.9	12,517.7	-191.21	4.231		
Tropical fruits	13,588	13,718	16,290	18,731	21,943	15,418	2,466.0	14,618.7	428.61	42.803	13,546	June 1949
Melons	6,006	5,277	4,461	4,374	4,500	4,984	272.4	4,762.2	-136.00	11.883	4,373	Mar. 1960
Other fruits	9,373	9,591	10,480	11,151	11,973	10,116	1,267.2	9,960.3	148.22	8.376	9,305	Aug. 1945
Total fruits	42,793	41,718	43,211	45,779	49,562	43,116	3,554.4	41,857.3	248.93	67.464	41,628	Aug. 1952
Fruits and vegetables	83,617	83,200	88,739	94,695	102,776	87,111	d/	84,907.7	923.22	118.015	83,103	Aug. 1950
Potatoes	13,830	17,131	22,296	24,160	25,545	19,457	4,093.6	19,952.6	860.8	-26.604		

a/ Estimated by the parabolic trend $Y = A + BT + CT^2$ where T is time measured in years from 1954 and coefficients have the values shown to the right. The estimate for 1954 is the value of A.

b/ The 15 annual prices (or quantities) were used to determine, by the method of least squares, the "best" parabolic trend for 1947-61. The symbols represent the following measures: M--mean; SD--standard deviation; A, B and C--coefficients in the regression equation.

c/ Value at and date for maximum or minimum on trend. Maximum is denoted by *. Other values are for minimum points. The bend point is shown only if it occurs within the period 1943-65.

d/ Not computed.

Source: The annual data used for computing the statistical measures are given in Appendix Tables A-1 to A-9 and B-4.

TABLE B-3

Vine Vegetables: Deliveries to Honolulu (1,000 pounds),[a/] by months and origin, 1947-61

Origin	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
						1957-61 average							
Beans, snap													
Oahu	98	88	111	115	127	103	100	93	98	110	94	82	1,219
Other islands	11	12	13	25	26	16	13	11	20	16	10	6	179
Total	109	100	124	140	153	119	113	104	118	126	104	88	1,398
Cucumbers													
Oahu	96	95	91	145	155	115	107	104	119	110	97	82	1,316
Other islands	101	89	122	132	136	131	113	124	123	111	101	122	1,405
Imports	0	0	0	0	0	0	3	4	3	0	5	1	16
Total	197	184	213	277	291	246	223	232	245	221	203	205	2,737
Tomatoes													
Oahu	67	62	70	134	192	180	190	136	97	145	124	99	1,496
Other islands	342	318	299	331	310	279	251	181	121	122	184	286	3,024
Imports	86	102	148	37	35	65	139	253	342	308	205	97	1,817
Total	495	482	517	502	537	524	580	570	560	575	513	482	6,337

Origin	Beans, snap			Cucumbers			Tomatoes		
	1947-51	1952-56	1957-61	1947-51	1952-56	1957-61	1947-51	1952-56	1957-61
Oahu	1,140	1,426	1,219	890	1,618	1,316	1,705	2,707	1,496
Hawaii	85	13	34	984	521	626	360	437	1,023
Maui	66	89	88	152	247	278	1,150	787	1,398
Kauai	38	32	56	126	326	488	326	520	533
Molokai	1	0	1	1	3	13	18	58	70
Imports	7	0	0	39	18	16	1,745	1,182	1,817
Total	1,337	1,560	1,398	2,192	2,733	2,737	5,304	5,691	6,337

a/ Imports include unloads from sources other than the islands. They come almost entirely from the U. S. Mainland--see Table B-5 for foreign unloads.

Source: "Honolulu Unloads," annual reports.

TABLE B-4

Fresh Fruits and Vegetables: Annual Deliveries to Honolulu,[a/] 1947-61

Year	Fruits					Vegetables					Fruits & Vegs.	Potatoes
	Citrus	Tropical	Melons	Other	Total	Leafy	Root	Vine	Other	Total		
					1,000 pounds							
1947	16,192	14,660	5,756	11,978	48,586	14,520	15,219	10,221	5,470	45,430	94,016	15,180
1948	14,564	15,862	7,364	7,458	45,248	15,263	13,267	10,061	4,872	43,463	88,711	13,558
1949	10,545	11,185	4,258	8,217	34,205	12,992	13,586	9,357	3,844	39,779	73,984	14,171
1950	11,764	12,960	6,197	9,438	40,359	13,536	13,861	8,884	4,431	40,712	81,071	14,446
1951	14,523	11,595	5,448	9,900	41,466	13,852	13,547	8,877	4,330	40,606	82,072	17,374
1952	11,394	13,098	5,298	8,567	38,357	13,287	12,781	9,912	4,233	40,213	78,570	14,431
1953	12,634	15,342	4,660	9,614	42,250	14,761	14,066	9,839	4,868	43,534	85,784	18,931
1954	12,900	15,016	4,605	10,787	43,308	16,160	14,835	9,831	5,429	46,255	89,563	21,201
1955	12,623	15,099	4,568	9,516	41,806	17,616	13,565	11,412	5,416	48,009	89,815	21,123
1956	13,241	15,197	4,251	11,636	44,325	18,743	15,176	11,548	5,876	51,343	95,668	22,215
1957	13,227	18,372	4,331	10,767	46,697	18,747	14,645	11,017	6,094	50,503	97,200	23,829
1958	11,867	18,588	4,849	11,248	46,552	19,487	14,591	11,372	5,756	51,206	97,758	25,925
1959	12,135	18,429	4,639	10,981	46,184	19,380	14,375	11,242	5,459	50,456	96,640	23,432
1960	10,632	16,244	4,263	11,161	42,300	19,732	13,882	10,512	5,926	50,052	92,352	22,505
1961	10,732	19,616	4,269	10,480	45,097	20,247	14,713	10,830	5,908	51,698	96,795	23,505
Average												
1947-51	13,518	13,252	5,805	9,398	41,973	14,033	13,896	9,480	4,589	41,998	83,971	14,946
1952-56	12,558	14,751	4,676	10,024	42,009	16,114	14,085	10,508	5,164	45,871	87,880	19,580
1957-61	11,719	18,250	4,470	10,927	45,366	19,518	14,441	10,995	5,829	50,783	96,149	23,839
1947-61	12,598	15,418	4,984	10,116	43,116	16,555	14,141	10,328	5,194	46,218	89,334	19,455
1957-61 average					Origin--percent of total							
Oahu	0	59.8	51.4	0	29.0	34.5	21.2	36.7	37.8	31.6	30.4	0
Hawaii	6.0	34.4	0.1	0.1	15.3	8.4	4.5	16.9	15.6	10.0	12.5	0
Other islands[b/]	0	5.8	8.2	0.3	3.2	37.0	10.5	28.6	8.9	24.4	14.4	0.4
Imports[c/]	94.0	0	40.3	99.6	52.5	20.1	63.8	17.8	37.7	34.0	42.7	99.6

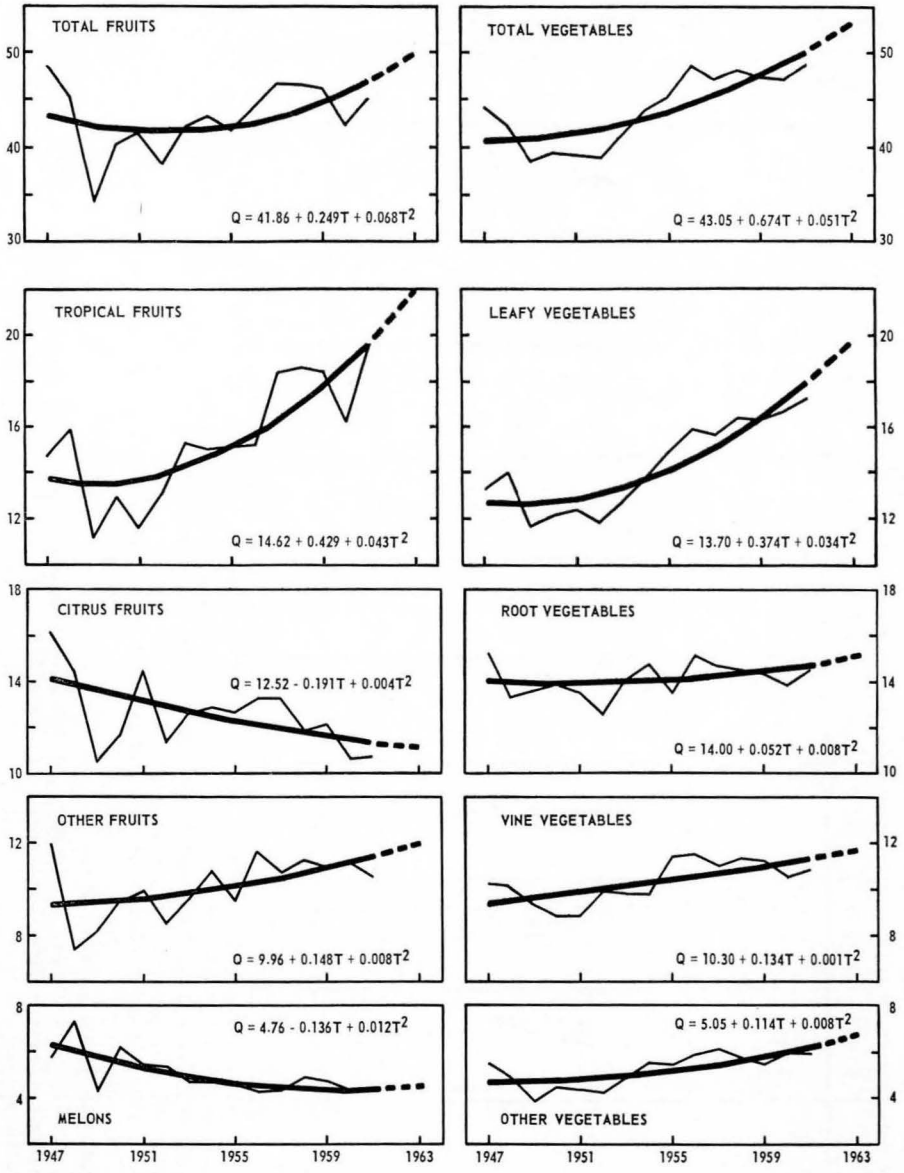
a/ The major items omitted by the source data are deliveries of pineapples and Oahu marketings of avocados and mangos. This exclusion understates the importance of Oahu as a source of tropical fruits (and of all fruits).

b/ Maui is a more important source of Honolulu supplies for most of these products than Kauai and Molokai combined.

c/ Includes unloads from sources other than the islands. They come predominately from the U. S. Mainland.

Source: "Honolulu Unloads," annual reports.

FIGURE B-1. Fresh fruits and vegetables: Annual deliveries to Honolulu wholesale market, 1947–61—million pounds.



NOTE: In the trend equations, T is time measured in years from 1954.

Based on tables B-2 and B-4.

TABLE B-5

Fresh Fruits, Vegetables, and Potatoes: Honolulu Unloads from Foreign Countries, 1947-61[a/]

Commodity	1948	1949	1952	1954	1957	1958	1959	1960	1961	Average 1947-56	Average 1957-61
					1,000 pounds						
Apples	1,391	542	36	170	120	947	952	996	1,212	236.2	845.4
Pears	59	161			45	81			43	22.0	33.8
Plums					1	55	16	23	27	0	24.4
Other fruits[b/]		69				3		1	46	6.9	10.0
Fruits	1,450	772	36	170	166	1,086	968	1,020	1,328	265.1	913.6
Onions, dry	716	46	712			220	903		419	147.4	308.4
Cabbage, head		30	84						0	11.4	0
Carrots	446	205	122	4					60	77.7	12.0
Cauliflower	5	11	12						0	2.8	0
Celery	225	183	94						24	50.2	4.8
Garlic	28	33	54						20	13.4	4.0
Ginger root		1	10			10			0	5.9	2.0
Lettuce		0	14						24	1.4	4.8
Tomatoes	24	42	12						18	7.8	3.6
Other vegetables[c/]	44	7	1						4	5.7	0.8
Vegetables	1,488	558	1,115	4	0	230	903	0	569	323.7	340.4
Potatoes	2,362	451	1,306	195						431.4	0
Total	5,300	1,781	2,457	369	166	1,316	1,871	1,020	1,897	1,020.2	1,254.0

a/ Foreign unloads were zero in 1947, 1955, and 1956. In the other unlisted years they were (in 1,000 pounds):
1950--apples, 176; garlic, 8; unspecified vegetables, 2; total, 186.
1951--apples, 7; garlic, 2; ginger root, 47; unspecified vegetables, 3; total, 59.
1953--apples, 40; garlic, 9; ginger root, 1; total, 50.

b/ These quantities consisted entirely of peaches in 1949 and of cherries in 1958 and 1960. The 1961 figure includes grapefruit, 11; oranges, 32; watermelon, 3.

c/ The quantities (in 1,000 pounds) were:
1948--pumpkin, 4; turnips, 7; squash, 25; unspecified, 8.
1949--peppers, 1; turnips, 1; squash, 1; unspecified, 4.
1952--dasheen, 1.
1961--burdock, 4.

Source: "Honolulu Unloads," annual reports.

TABLE B-6

Frozen Fruits, Vegetables, and Juices: Honolulu Unloads from the U. S. Mainland, 1947-61[a/]

Commodity	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	Averages 1948-51	Averages 1952-56	Averages 1957-61
			Frozen fruits and vegetables--1,000 pounds										
Berries	309	396	304	315	346	302	264	282	263	308	326.3	334.0	283.8
Other fruits	95	86	89	110	102	99	81	117	124	134	59.3	96.4	111.0
Fruits	404	482	393	425	448	401	345	399	387	442	385.6	430.4	394.8
Beans, lima	115	107	118	132	131	128	139	131	115	102	75.8	120.6	123.0
Beans, snap	125	152	163	206	226	267	255	268	269	237	74.5	174.4	259.2
Broccoli	82	106	116	123	155	190	179	194	172	169	53.7	116.4	180.8
Corn	89	98	105	123	186	191	195	235	244	295	89.5	120.2	232.0
Peas	228	237	336	355	401	460	443	458	450	460	183.5	311.4	454.2
Peas/carrots	44	60	55	76	107	126	140	146	158	154	24.8	68.4	144.8
Potatoes	25	44	41	57	80	89	87	114	161	207	11.5	49.4	131.6
Spinach	74	78	88	104	137	127	103	141	135	138	47.8	96.2	128.8
Succotash	12	13	20	20	31	27	20	17	12	12	10.7	19.2	17.6
Mixed vegetables	80	105	134	158	185	197	195	225	215	185	52.5	132.4	203.4
Other vegetables	102	138	157	158	165	176	134	151	109	124	97.5	144.0	138.8
Vegetables	976	1,138	1,333	1,512	1,804	1,978	1,890	2,080	2,040	2,083	721.8	1,352.6	2,014.2
Unspecified	60	30	8	13	3	8	6	7	10	0	39.3	22.8	6.2
			Frozen juices--1,000 gallons										
Orange	49.2	42.2	51.2	47.0	59.3	64.2	39.1	48.3	53.1	64.8		49.76	53.90
Lemonade	2.0	10.2	9.8	8.4	8.0	10.3	8.7	10.4	6.3	9.5		7.68	9.03
Other citrus	4.3	7.8	6.2	5.7	11.5	8.6	5.0	6.6	6.0	5.7		7.11	6.39
Grape	3.0	5.5	5.2	4.9	8.0	7.8	5.4	7.5	9.1	9.5		5.33	7.87
Unspecified	1.0	1.1	.1	.3	.3	.5	.4	.4	.3	.3		.56	.37
Juices	59.5	66.8	72.5	66.3	87.1	91.4	58.6	73.2	74.8	89.8		70.44	77.56

a/ Unloads of frozen fruits and frozen vegetables (exclusive of unspecified items) were (in 1,000 pounds), respectively: 868 and 1,197 in 1947 (the first year reported); 260 and 605 in 1948; 353 and 734 in 1949; 447 and 730 in 1950; 482 and 818 in 1951. Unloads of frozen juices totalled 45,788 gallons in 1951, the first year for which they were reported.

Source: "Honolulu Unloads," annual reports.

TABLE B-7

Economic Activity in Hawaii: Consumer Prices, Personal Income, and Population, 1940-62

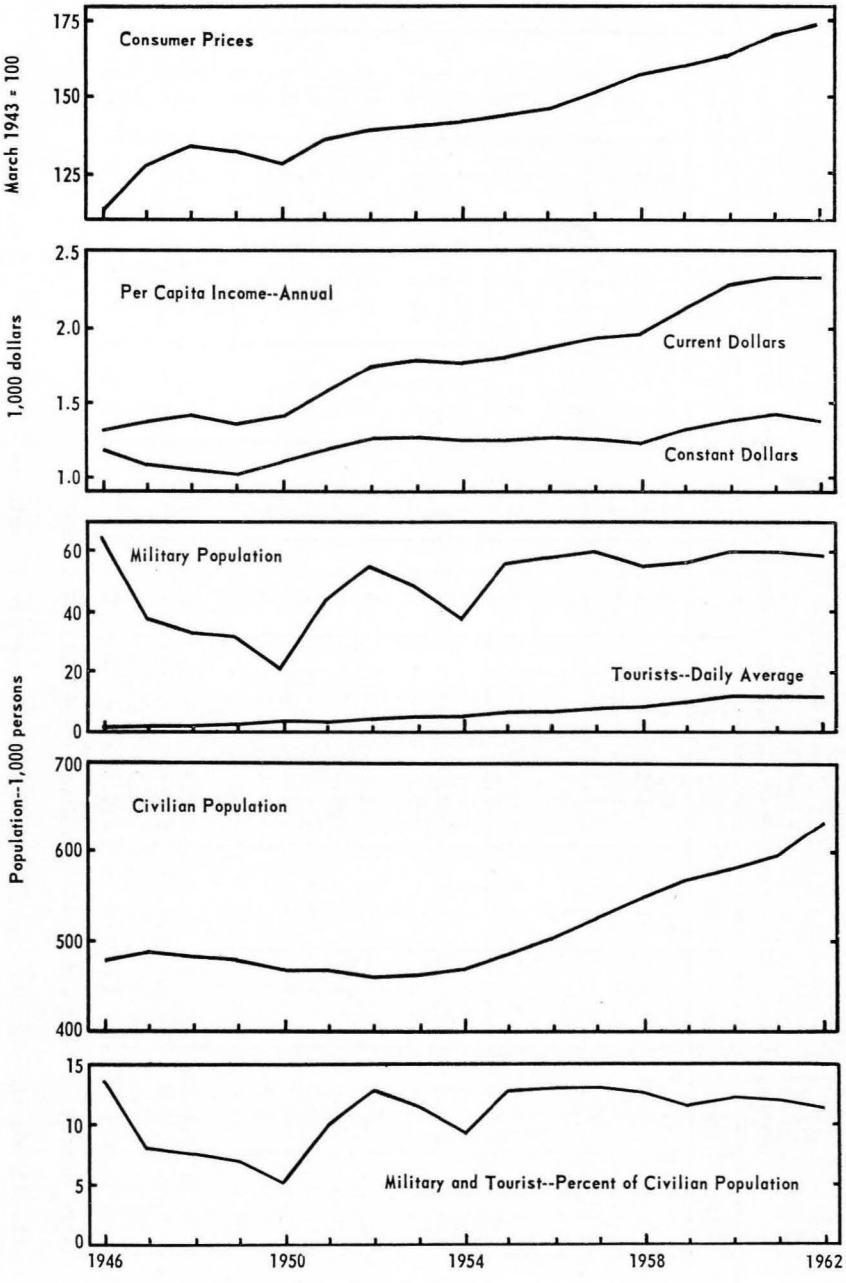
Year	Consumer Prices[a] (1943 = 100)	Personal Income (dollars per capita)		Population, as of July 1 (1,000 persons)			Tourists			Military and Tourists (per 1,000 civilian residents)		
		Current	Real	Total	Military	Civilian	Total per year	Average per day	Average stay (days)	Military	Tourists	Total
1	2	3	4	5	6	7	8	9	10	11	12	13
Annual												
1940	77.9	577	741	428	30	398	25,400			75.1		
1945	104.3	1,328	1,273	815	355	460				771.7		
1946	111.3	1,312	1,179	545	65	480	15,000	980	23.7	135.4	2.0	137.4
1947	127.5	1,384	1,085	526	38	488	25,000	1,620	23.7	77.9	3.3	81.2
1948	134.1	1,411	1,052	517	33	484	36,400	2,370	23.7	68.2	4.9	73.1
1949	132.2	1,354	1,024	511	31	480	34,400	2,240	23.7	64.6	4.7	69.3
1950	127.7	1,403	1,099	491	21	470	46,600	3,030	23.7	44.7	6.4	51.1
1951	135.7	1,589	1,171	513	44	469	51,600	3,350	23.7	93.8	7.1	100.9
1952	139.2	1,745	1,254	515	55	460	60,500	3,800	22.9	119.6	8.3	127.9
1953	140.4	1,782	1,269	511	48	463	80,300	4,750	21.6	103.7	10.3	114.0
1954	141.8	1,768	1,247	507	38	469	91,300	5,370	21.4	81.0	11.4	92.4
1955	143.8	1,789	1,244	541	56	485	109,800	6,040	20.1	115.5	12.5	128.0
1956	145.8	1,862	1,277	561	58	503	133,800	6,950	18.9	115.3	13.8	129.1
1957	151.0	1,916	1,269	585	60	525	168,800	8,200	17.7	114.3	15.6	129.9
1958	157.4	1,946	1,236	605	55	550	171,600	8,400	17.9	110.0	15.3	125.3
1959	160.5	2,118	1,320	620	56	564	243,200	10,390	15.6	99.3	18.4	117.7
1960	164.2	2,274[b]	1,385	642	60	582	296,500	11,800	14.5	103.1	20.3	123.4
1961	169.7[b]	2,407[b]	1,418	657	60	597	319,400	11,960	13.7	100.5	20.0	120.5
1962[c]	173.8	2,409	1,386	691	59	632	362,100	11,900	12.0	93.4	18.8	112.2
Average												
1947-51	131.4	1,428	1,086	511.6	33.4	478.2	38,800	2,522	23.7	69.8	5.3	75.1
1952-56	142.2	1,789	1,258	527.0	51.0	476.0	95,140	5,382	21.0	107.0	11.3	118.3
1957-61	160.6	2,132	1,326	621.8	58.2	563.6	239,900	10,150	15.9	105.4	17.9	123.4

a/ Index for all items, combined, for Honolulu, March 1943 = 100.
b/ Revisions to source data from government reports.
c/ Preliminary--generally based on government reports.

Sources: Columns 2, 3, and 5-9 are from Hawaii State Department of Planning and Research, "Historical Statistics of Hawaii, 1778-1962," September 1962 (41 pp., proc.), pages 7, 15, and 22.
Other data are derived as follows:

Col. 4 = Col. 3 ÷ Col. 2
Col. 10 = 365 x Col. 9 ÷ Col. 8
Col. 11 = 1,000 x Col. 6 ÷ Col. 7
Col. 12 = 1,000 x Col. 9 ÷ Col. 7
Col. 13 = Col. 11 + Col. 12

FIGURE B-2. Consumer prices, income, and population, Hawaii, 1946–62.



Based on table B-7.

TABLE B-8

Beans, Snap: Price Residuals (cents per pound) for Monthly Analysis, 1947-62

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
1947	-5.6	-3.5	-4.9	11.6	1.5	0.7	3.3	-0.7	-1.0	4.0	-3.6	0	0.15
1948	2.2	0.3	10.8	-1.7	-1.1	0.1	4.4	-1.1	-0.3	2.8	5.0	5.8	2.27
1949	-5.0	3.6	-4.1	-4.7	-1.5	-2.2	-3.0	-1.7	-3.3	-0.8	-0.7	-6.5	-2.49
1950	-2.6	-2.0	-3.3	-1.1	1.1	-2.9	-2.5	-3.6	-0.1	-4.5	-7.6	-1.4	-2.54
1951	-2.8	-2.8	-2.0	9.7	1.2	1.7	2.1	2.1	-8.7	-0.4	0	1.2	0.11
1952	3.0	1.2	0.9	2.5	3.8	4.9	5.1	0.7	2.2	2.4	4.3	3.2	2.85
1953	-0.2	6.6	0.3	0.9	-0.1	2.9	1.5	-1.5	2.2	-2.2	3.5	-4.9	0.75
1954	-3.0	-4.5	0.6	-1.8	2.1	-1.7	-1.9	-2.1	4.4	-0.1	-3.8	-3.6	-1.28
1955	2.8	4.6	1.1	-1.7	2.3	3.3	-2.5	0.7	-2.8	-0.9	-6.5	6.1	0.54
1956	1.6	1.2	4.5	-3.3	0	1.4	4.4	-1.1	0.9	-2.6	0.6	1.1	0.72
1957	-2.8	-7.1	1.0	-2.2	4.0	-3.1	2.9	3.2	2.5	4.4	1.5	-6.3	-0.17
1958	6.8	-1.4	-3.6	1.4	-3.7	-6.7	-3.5	-5.0	4.0	6.8	-0.2	-3.2	-0.69
1959	-7.2	0.8	2.5	-4.8	-1.3	-1.7	1.7	5.7	4.4	-2.1	-1.9	4.8	0.08
1960	6.6	-4.2	-2.0	-5.2	1.8	4.6	4.5	1.2	3.1	1.6	4.3	2.4	1.56
1961	6.0	1.8	3.7	-4.3	-1.6	-4.3	-3.5	-6.9	1.1	-3.7	-0.7	3.7	-0.72
1962	-3.4	0.4	1.6	-1.8	-5.5	-3.3	-5.1	-0.9	-6.3	-11.9	-7.3	-7.6	-4.26
Average[a/]													
1947-51	-2.76	-0.88	-0.70	2.76	0.24	-0.52	0.86	-1.00	-2.68	0.22	-1.38	-0.18	-0.502
1952-56	0.84	1.82	1.48	-0.68	1.62	2.16	1.32	-0.66	1.38	-0.68	-0.38	0.38	0.717
1957-61	1.88	-2.02	0.32	-3.02	-0.16	-2.24	0.42	-0.36	3.02	1.40	0.60	0.28	0.010
1947-61	-0.01	-0.36	0.37	-0.31	0.57	-0.20	0.87	-0.67	0.57	0.31	-0.39	0.16	0.075

a/ The standard deviation of the monthly residuals (1947-61) is 3.6597.

Source: Derived from the regressions presented in text applied to data in Tables A-1 to A-5.

TABLE B-9

Cucumbers: Price Residuals (cents per pound) for Monthly Analysis, 1947-62

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
1947	4.0	-2.5	6.7	6.7	-1.1	0.2	-0.7	2.2	-1.3	5.0	-2.4	2.6	1.62
1948	1.9	2.2	1.3	-4.6	1.2	-3.7	5.2	-0.1	1.6	-2.4	-0.9	-2.6	-0.08
1949	-3.2	5.0	5.4	-3.3	-4.0	0.1	0.6	-3.1	-0.3	-2.0	-3.1	-2.3	-0.85
1950	-2.2	0.2	1.4	-5.8	0.2	1.7	1.3	0.4	1.1	-4.0	-3.9	-2.3	-0.99
1951	5.5	-1.6	-0.6	2.2	7.0	2.3	-6.0	-2.7	-0.2	1.0	3.8	6.5	1.43
1952	2.0	0	-5.0	4.7	-0.9	4.6	0.2	5.8	-3.6	-0.4	-1.7	-2.1	0.30
1953	-4.8	-6.5	2.6	1.2	-0.8	4.4	0.1	-0.9	-6.1	-1.0	0.2	-3.3	-1.24
1954	-2.8	-4.5	1.4	-0.7	-0.5	0.2	-0.1	-0.8	0.2	3.7	-2.6	3.2	-0.28
1955	0.8	3.8	5.6	-0.8	-0.2	-1.7	-3.3	-3.4	-3.1	1.9	-2.1	3.0	0.04
1956	-2.0.	3.8	-1.7	0.9	2.8	0.4	3.1	2.1	2.3	-0.9	-0.8	-6.9	0.26
1957	7.0	-0.8	-3.1	-0.3	4.9	0.4	1.6	3.7	-1.4	-1.6	2.4	4.9	1.48
1958	1.6	-0.4	0.5	1.5	-2.0	-3.5	0.1	5.9	5.5	1.9	2.8	-2.7	0.93
1959	-6.0	0.2	-6.4	-4.6	-6.4	-0.2	2.6	0.3	3.1	-3.3	2.2	1.1	-1.45
1960	2.0	2.4	2.8	5.8	-0.8	-2.2	-1.9	-1.3	-0.8	-1.3	4.2	-2.0	0.58
1961	-3.2	-4.8	3.6	-2.7	3.7	0.6	-0.7	-2.7	0.7	-2.8	3.6	-2.6	-0.61
1962	2.4	6.6	-5.2	-1.2	0.8	-2.2	-0.6	-3.9	-4.3	-3.2	-3.1	-4.9	-1.57
Average[a]/													
1947-51	1.20	0.66	2.84	-0.96	0.66	0.12	0.08	-0.66	0.18	-0.48	-1.30	0.38	0.227
1952-56	-1.36	-0.68	0.58	1.06	0.08	1.58	0	0.56	-2.06	0.66	-1.40	-1.22	-0.186
1957-61	0.28	-0.68	-0.52	-0.06	-0.12	-0.98	0.34	1.18	1.42	-1.42	3.04	-0.26	0.186
1947-61	0.04	-0.23	0.97	0.01	0.21	0.24	0.14	0.36	-0.15	-0.41	0.11	-0.37	0.077

a/ The standard deviation of the monthly residuals (1947-61) is 3.1410.

Source: Derived from the regressions presented in text applied to data in Tables A-2 and A-6.

TABLE B-10

Tomatoes: Price Residuals (cents per pound) for Monthly Analysis, 1947-62

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
1947	-0.1	-3.2	1.2	1.7	3.0	-3.1	-0.7	0.7	-5.5	-0.2	-5.4	5.0	-0.55
1948	2.3	3.2	6.1	2.4	-0.4	-1.0	-0.2	1.0	0.9	5.7	-3.8	-3.6	1.05
1949	-3.1	-1.4	1.2	-1.3	-6.2	-6.4	-1.0	6.1	2.7	0.4	-5.7	-2.9	-1.47
1950	-0.4	-1.5	-0.6	-3.4	-0.8	2.3	0.8	2.4	-0.7	0.7	-7.4	1.5	-0.59
1951	1.4	3.3	2.5	8.1	9.0	-2.5	-3.8	-3.0	-1.7	1.9	-0.1	3.0	1.51
1952	2.9	1.1	-0.7	-2.8	0.8	-3.6	3.7	1.7	-3.1	-1.3	-4.3	1.2	-0.37
1953	0.8	-1.4	-3.9	-3.0	-5.3	-1.1	2.7	2.6	-2.8	-0.7	-5.7	-4.6	-1.87
1954	-3.7	-4.4	1.4	-2.1	4.6	-2.6	0.3	1.6	-1.7	-0.3	-3.2	3.6	-0.54
1955	0.3	1.9	1.8	3.3	1.5	-3.4	-3.5	-2.2	-2.3	1.5	-2.7	-1.2	-0.42
1956	4.1	7.5	7.9	3.2	1.8	-2.3	3.4	-0.2	3.6	0.5	-1.6	8.1	3.00
1957	0.7	-6.3	-4.0	1.4	2.9	5.5	2.9	1.0	3.2	2.0	2.3	3.6	1.27
1958	3.6	4.3	-3.7	0.9	-0.1	1.3	0.2	0.8	0.2	2.7	-0.2	-4.8	0.43
1959	-4.7	-2.3	-1.9	-2.5	-3.4	3.2	-0.9	1.3	3.1	1.9	3.3	4.0	0.09
1960	2.6	0	1.6	-0.6	2.2	2.1	-2.0	0	-3.1	-0.6	0.6	1.4	0.35
1961	-6.9	-9.6	-3.3	-0.3	-3.4	1.7	6.7	1.4	0.4	2.6	0.5	-2.2	-1.03
1962	-0.5	-2.4	-7.1	-11.0	-6.5	2.5	-2.8	-6.8	-4.7	-6.7	-6.4	-10.6	-5.25
Average[a/]													
1947-51	0.02	0.08	2.08	1.50	0.92	-2.14	-0.98	1.44	-0.86	1.70	-4.48	0.60	-0.010
1952-56	0.88	0.94	1.30	-0.28	0.68	-2.60	1.32	0.70	-1.26	-0.06	-3.50	1.42	-0.038
1957-61	-0.94	-2.78	-2.26	-0.22	-0.36	2.76	1.38	0.90	0.76	1.72	1.30	0.40	0.222
1947-61	-0.01	-0.59	0.37	0.33	0.41	-0.66	0.57	1.01	-0.45	1.12	-2.23	0.81	0.058

a/ The standard deviation of the monthly residuals (1947-61) is 3.2618.

Source: Derived from the regressions presented in text applied to data in Tables A-3 and A-7.

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